N E W S L E T T E R

CLOVERS AND SPECIAL PURPOSE LEGUMES RESEARCH

Vol. 6--1972

Compiled by the Forage and Range Research Branch
Plant Science Research Division, Agricultural Research Service
U. S. Department of Agriculture, Beltsville, Maryland

TABLE OF CONTENTS

******

INTRODUCTION

The first request for contributions to "Clover and Special Purpose Legumes Research Newsletter" was in March of 1967. The objective of the Newsletter has been the informal exchange of research information not available by other media. We have called for contributions to the Newsletter each succeeding spring. This is our Sixth Newsletter - we are almost established! Your response to our request for contributions has been generous, and it has been our pleasure in Forage and Range Research Branch to compile this Newsletter for you.

The reorganization of Agricultural Research Service began July 1, 1972. Our former Investigations, Branches, and Divisions in ARS are gone. Some of us in ARS continue in essentially the same job as previously. Some of us have been reassigned. Provisions for regional and national research programs are not yet complete. I'm sure that our essential research needs will be provided in the future. At this date, I can only assume that the future of this Newsletter will be decided by you, the contributors. To each contributor, through these six years of the Newsletter, I wish to express our thanks, and our best wishes for the future.

September 11, 1972

Bob Leffel

R. C. Leffel, Leader
Plant Nutrition Laboratory
Plant Physiology Institute
Agricultural Research Center

******

ALABAMA

Yuchi Arrowleaf Clover, Caley Peas, Regal Ladino Clover, Crimson Clover, Sericea Lespedeza, Crownvetch, and Jointvetch

Carl S. Hoveland (Auburn)

Yuchi arrowleaf clover (Trifolium vesiculosum) and crimson clover (T. incarnatum).

Grazing experiments continue to show excellent results with this clover. In the Piedmont of Alabama, beef cows and calves were grazed for 3 years on Coastal bermudagrass fertilized with 100 lb/A N and overseeded with 8 lb/A Yuchi arrowleaf clover (6). Calf gains ranged from 2.5 lb/day with clover in the sward to 1 lb or less when clover was absent. Yuchi arrowleaf furnished grazing from the first of April until July (at this location Coastal bermuda alone furnishes little grazing until late May or June). Yuchi arrowleaf furnished clover grazing from the first of April until July. Calf gains averaged 310 lb/A annually on the clover-grass as compared with only 180 lb/A in the preceding 4-year period when no clover was planted on Coastal bermuda fertilized with the same rate of N.

On a sandy Coastal Plain soil in south Alabama, beef cows and calves were grazed on N-fertilized Coastal bermudagrass for two years (2). Sale weight of calves on the all-grass pasture was only 363 lbs as compared with 478 lbs for calves on Coastal bermuda overseeded with a mixture of Autauge crimson and Yuchi arrowleaf clovers.

Getting clover stands on dense warm season perennial grass sods is a problem that can be solved by removing old grass stubble in the autumn (8). In a 2-year experiment at Auburn, Pensacola bahiagrass stubble heights of 1, 3, and 6 inches resulted in dry clover yields of 2,290, 1,620, and 1,350 lbs/A Yuchi arrowleaf clover and 1,070, 780, and 430 lb/A crimson clover, respectively. Treatment with diazanon granules to control striped field crickets is also important for success in first year stands on grass sod.

Yuchi arrowleaf clover, planted in combination with small grain and ryegrass, has become a recommended winter annual grazing mixture for growing steers. Grazing results the winter of 1971-72 at the Piedmont Substation are similar to the past four years. This season, steers were grazed continuously from November 8 until June 5, gaining 2.16 lb/day and a total of 454 lb/steer. Clover quality remained satisfactory when drought in late May as evidenced by the 2 lb/day gain made by steers in the two week period just prior to slaughter.

In the Tennessee Valley of northern Alabama, yearling steers grazed from October to late December and early March to June (4). Gains were 2 lbs/day per steer on small grain-ryegrass with Yuchi arrowleaf clover as compared to only 1.4 pound on small grain-ryegrass. Yuchi arrowleaf-rye-ryegrass yielded 900 lb/acre more forage than crimson clover in combination with rye and ryegrass on Coastal Plain soil in south Alabama (11). The longer grazing season from the clover makes it a more

profitable annually seeded pasture than grass alone. Hay yields of over 2 tons per acre can be obtained in May from Yuchi when grazing is terminated by early April (9).

Poor nodulation has been a problem when Yuchi arrowleaf is planted the first time on sandy soils. Increasing the inoculation rate by 2 or 3 times that the normal recommended rate helps but pelleting the clover seed with methyl cellulose, inoculum, and $CaCO_3$ has been even more successful (12). Winter forage yields were increased 300% as compared to the normal rate of inoculum. Total annual dry forage yields were increased as much as 2,500 lb/A by planting pelleted seed.

Caley peas (Lathyrus hirsutus)

Beef cows and calves were grazed under several pasture systems at the Black Belt Substation for 4 years (10). Coastal bermuda-caley peas furnished twice the stocking rate and more weight gain per acre (440 vs. 240 lbs) than dallisgrass-white clover-caley peas. However, calves were lighter (440 vs. 480 lbs) on the Coastal bermuda-caley peas.

Regal Ladino clover (Trifolium repens).

In an 8-year experiment at the Tennessee Valley Substation (3) inclusion of Regal ladino clover in orchardgrass swards did not improve average daily gain of grazed steers (1.77 vs. 1.83 lbs). However, a higher rate of gain was obtained when clover was grown with tall fescue (1.31 vs. 1.46 lbs). Nitrogen at the rate of 150 lb/A was used with grass stands to replace legume N from grass-legume mixtures. Beef gain averaged 360 and 314 lb/A annually from fescue orchardgrass, respectively. Slightly less than 100 lbs of this gain was produced during the fall.

Sericea lespedeza (Lespedeza cuneata).

Acreage of Interstate sericea for seed production is increasing. This new variety is short, fine-stemmed, and branches profusely. Developed for roadside stabilization and cover, it also appears to have forage potential.

In a 2-year management experiment in central Alabama, sericea forage yields were highest (4 to 5 tons/A annually) when sericea was cut for hay twice each year (5). Interstate was about as productive as the Serala variety. Cutting four times each year reduced forage yield to half that produced when cut twice a year. Leaving a 5-inch stubble resulted in better stands, more root carbohydrates and higher forage yields than a 1-1/2 inch stubble when cut 4 times annually. Digestible dry matter (in-vivo nylon bag method) of both sericea varieties were similar, averaging 50% or less over the year. Sericea cut 4 times a year was higher in quality, averaging over 55% DDM.

In a grazing trial with steers, crude protein and dry matter of low tannin sericea were more highly digested than that in high-tannin sericea (1). Tannin content was 76% lower in low-tannin sericea than in high-tannin sericea.

Jointvetch (Aeschynomene).

Poor growth of this species has been obtained until late summer. DDM of the forage averaged 60%, suggesting that it may be of value.

Crownvetch (Coronilla varia).

Our 4-year old pasture plantings of crownvetch finally grew enough to cover the soil. However, poor yields suggest that it has little promise for forage in our area.

Publications:

1. Donnelly, E. D., W. B. Anthony, and J. W. Langford. 1971. Nutritive relationships in low- and high-tannin sericea lespedeza under grazing. Agron. J. 63:749-751.

2. Evans, E. M., W. B. Anthony, R. R. Harris, V. L. Brown, C. C. King, Jr., and S. C. Bell. 1972. Crops or cattle or both for productive land. Auburn Univ. Agr. Exp. Sta. Highlights of Agr. Res. Vol. 19, No. 1.

3. Harris, R. R., E. M. Evans, J. K. Boseck, and W. B. Webster. 1972. Fescue, orchardgrass, and Coastal bermudagrass grazing for yearling beef steers. Auburn Univ. Agr. Exp. Sta. Bul. 432.

4. Harris, R. R., C. S. Hoveland, J. K. Boseck, and W. B. Webster. 1972. Wheat, oats, or rye with ryegrass and Yuchi arrowleaf clover as grazing for stocker calves. Auburn Univ. Agr. Exp. Sta. Circ. 197.

5. Hoveland, C. S., W. B. Anthony, and F. T. Glaze. 1972. Managing sericea for forage. Auburn Univ. Agr. Exp. Sta. Highlights of Agr. Res. Vol. 19, No. 1.

6. Hoveland, C. S., W. B. Anthony, E. L. Mayton, and H. E. Burgess. 1972. Pastures for beef cattle in the Piedmont (Serala sericea, dallisgrass-Regal ladino clover, Coastal bermuda-Yuchi arrowleaf clover). Auburn Univ. Agr. Exp. Sta. Circ. 196.

7. Hoveland, C. S. and E. L. Carden. 1971. Overseeding sericea with winter annual grasses. Auburn Univ. Agr. Exp. Sta. Highlights of Agr. Res. Vol. 18, No. 3.

8. Hoveland, C. S., E. L. Carden, J. R. Wilson, and P. A. Mott. 1971. Summer grass residue affects growth of winter legumes under sod. Auburn Univ. Agr. Exp. Sta. Highlights of Agr. Res. Vol. 18, No. 3.

9. Hoveland, C. S., R. F. McCormick, W. B. Anthony, and F. T. Glaze. 1971. Managing arrowleaf clover for grazing and hay. Auburn Univ. Agr. Exp. Sta. Highlights of Agr. Res. Vol. 18, No. 4.

10. King, C. C., Jr., W. B. Anthony, S. C. Bell, L. A. Smith, and H. Grimes. 1971. Beef cow grazing systems compared on Eutaw clay (forages evaluated include fescue, dallisgrass, Coastal bermuda-grass, caley peas, white clover). Auburn Univ. Agr. Exp. Sta. Bul. 424.

11. King, C. C., Jr., V. L. Brown, and J. Richburg. 1972. How much N for winter annual legumes and grasses. Auburn Univ. Agr. Exp. Sta. Highlights of Agr. Res. Vol. 19, No. 2.

12. Wade, R. H., C. S. Hoveland, and A. E. Hiltbold. 1972. Inoculation essential for production of Yuchi arrowleaf clover. Auburn Univ. Agr. Exp. Sta. Highlights of Agr. Res. Vol. 19, No. 2.

***

ARIZONA

Preferential Grazing of Sainfoin by Deer

Robert E. Dennis (Hereford)

An alfalfa variety test was established at Hereford, Arizona, elevation 4200 feet in August 1970. Eskie Sainfoin was included as a comparison entry in this test. There is a high deer population in the Hereford area and they preferentially grazed the sainfoin and continuously kept the plants at or slightly above ground level. Plants of the variety Eskie were unable to persist under this severe pasture treatment. Palatability of sainfoin, at least for deer, was indicated to be excellent in this test planting.

******

ARIZONA

Sainfoin (*Onobrychis viciifolia* Scop.) flower volatiles

G. M. Loper (Tucson)

As a part of a study on the components of legume flower volatiles and their effects on honey bee foraging, sainfoin flower volatiles were analyzed by gas chromatography (GC) and by combined GC/Mass spectrometry (GC/MS). Quantitative GC samples of field-grown sanfoin flowers indicated an increase from approximately 17 ng/flower at 0810 hrs. to 37 ng/flower at 1210 hrs. This increase was followed by a decrease back down to approximately 12 ng/flower at 1610 hrs. Although many compounds were shown to be present in sainfoin flower aroma, myrcene - a ten carbon terpene - consistently made up 95% of all volatiles chromatographed. Myrcene was identified by its mass spectrum and by co-chromatography of known myrcene with the flower vapor sample. Bioassays with bees trained to visit at a test station went equally well to sites marked with myrcene (the training compound) and to sites marked with the aroma of sainfoin flowers.

***

CANADA

Publication: Taxonomy of *Trifolium* (Leguminosae). IV. The American Species of Section *Lupinaster* (Adamson) Seringe.

John M. Gillett (Ottawa, Ontario)

To appear in the Canadian Journal of Botany. Note change of assignment and address:

Dr. John M. Gillett, Curator of Vascular Plants
National Herbarium of Canada
National Museum of Natural Sciences
Ottawa, Ontario K1A 0M8
Canada

COLORADO

Comparison of I_1 and Open-Pollination Progenies of *Astragalus cicer* L. for Certain Agronomic Characters

C. E. Townsend (Ft. Collins)

I_1 and open-pollination (O.P.) progenies of 24 self-compatible I_0 plants of cicer milkvetch, *Astragalus cicer* L., were evaluated in the field for forage yield, height, spread, vigor score, and date of flowering. One generation of inbreeding had such a deleterious effect on plant vigor that paired I_1 and O.P. progenies could be differentiated visually. The mean relative forage yields of the I_1 progenies in comparison to their O.P. counterparts were 51%, 47%, and 51% for one harvest in 1970 and the first and second harvests in 1971, respectively. There was considerable variation among I_0 families for inbreeding depression. Inbreeding delayed flowering 10 days on the average in the seedling year, but there was little difference between the I_1 and O.P. progenies for mean data of flowering in subsequent harvests. There was no relationship between the self-compatibility (self-seeds per raceme) of the I_0 parents and forage yields of their I_1 and O.P. progenies. Self-pollination under open-pollination conditions was not believed to be a contributing factor to yield depression of O.P. progenies.

There were significant differences among I_0 parents for combining ability as measured by the performance of their O.P. progenies. Open-pollination progenies of several I_0 plants with average vigor performed better than similar progenies of I_0 plants with excellent vigor indicating that selection of parents for improved varieties must be based upon progeny tests.

Simple correlation coefficients among forage yield, height, spread, vigor score, and date of flowering were highly significant. The associations between vigor score and forage yield were the highest with coefficients of -0.93, -0.91, and -0.92 for the one harvest in 1970 and the first and second harvests in 1971, respectively.

Publications:

1. Townsend, C. E. 1971. Registration of C-1 zigzag clover germplasm. (Reg. No. GP 1). Crop Sci. 11:139.

2. Townsend, C. E. 1971. Association among characters related to seed production in *Astragalus cicer* L. Crop Sci. 11:307-308.

3. Townsend, C. E. 1971. Self-compatibility studies with *Astragalus cicer* L. Crop Sci. 11:769-770.

4. Townsend, C. E. 1971. Further studies on the inheritance of a self-compatibility response to temperature and the segregation of S alleles in diploid alsike clover. Crop Sci. 11:860-863.

***

FLORIDA

Evaluation of Clovers and Frost Lupine

Leonard S. Dunavin (Jay)

Variety trials:

Oven-dry forage yield of several clovers and frost lupine are present in Table 1 from trials conducted in 1971-72. The annual clovers and lupine were planted October 11, 1971, on a Red Bay fine sandy loam soil. Preplanting fertilization consisted of 250 lbs. per acre of 0-20-20. Irrigation was used in late October and November. Four replications were used. About 50% of the lupine was killed by a few cold nights which followed unseasonably warm weather. Stand loss was mostly on the north side of the plots and was possibly due to a very cold and dry wind. Data for the white clovers is second-year data and reflects stand loss. Maintenance fertilization on the white clovers was 250 lbs./acre of 0-20-20 applied October 5, 1971.

Table 1. Oven-dry forage produced by several clovers and Frost lupine. Agricultural Research Center, Jay, Florida, 1971-72.

Variety	Pounds Per Acre				
	22 Feb 72	17 Mar 72	14 Apr 72	19 May 72	Total
Dixie Crimson	1105	1982	2396	771	6254
Tibbee Crimson	1678	1851	1719	849	6097
Frontier Crimson	1350	1860	1635	855	5700
Autauga Crimson	777	2242	1788	695	5502
Auburn Crimson	909	2383	1464	627	5383
Yuchi Arrowleaf	619	1352	2257	929	5157
Amclo Arrowleaf	212	916	2287	777	4192
Meechee Arrowleaf	144	711	2228	968	4051
Miss. Ecotype Subclover	0	0	2294	473	2767
Ball	0	572	1089	540	2201
Frost lupine	561	148	212	108	1029
White clovers:			14 Apr 72	25 May 72	Total
Tillman			1568	1513	3081
Regal			1346	1006	2352
WFES #1			745	417	1162
Merit			183	394	577
Ladino			285	234	519
Espanso			229	241	470
Ladino Gigante			0	283	283
La. S-1			0	118	118
Minn. A Ladino			0	67	67

***

1970-71
WHITE CLOVER VARIETY TRIAL
Seeded November 19, 1971
Gainesville, Florida (BRU)

Variety		Pounds/Acre per Harvest Date 3/22/71 FTE	3/22/71 No FTE	4/21/71 FTE	4/21/71 No FTE	5/19/71 FTE	5/19/71 No FTE	6/23/71 FTE	6/23/71 No FTE	Average FTE	Average No FTE	lb/acre All Reps
Ladino Gigante Lodigano	39741	832	534	1248	1047	1374	1334	1036	884	4490	3826	4158
Espanso	40049	592	362	1254	892	984	916	849	651	3679	2821	3250
Espanso	39740	552	334	1326	1101	1096	1008	892	733	3866	3176	3521
Regal White	39975	1012	606	1774	1146	1186	1194	1192	883	5164	3829	4496
Nolin's Improved White	39974	924	443	936	728	1158	886	905	617	3923	2674	3298
La S-1 White	39977	892	630	1201	943	818	978	873	765	3784	3316	3550
Ladino	40008	810	570	1534	1376	1142	1434	1045	1014	4531	4394	4462
Common White	39976	654	432	1180	592	1237	908	921	490	3992	2422	3207
Merit White	39992	832	376	1661	738	1150	982	1093	628	4736	2724	3730
Tillman White	38339	792	729	1959	1415	1010	1070	1128	964	4889	4178	4534
Florida S-68	-----	648	621	1837	1640	846	1087	999	1004	4330	4352	4341
Lodigiano Gigante	40050	446	723	1176	1201	944	1053	769	893	3333	3870	3602
						Average yield FTE and No FTE and % difference				4226	3465	+ 21.96%

+ 21.96 percent increase all clovers from FTE 503
Planted 11/19/69 and treated with 20 lb. FTE/acre on half reps.
Fertilized November, 1970, with 500 lb. 0-14-14 per acre plus 30 lb. FTE 503 on half reps.
Very dry period from September, 1970, through June, 1971, with numerous frosts into April.
Four replications of each variety.
Note: FTE was applied in 1969 and 1970.

G.B.K.
Agron.-30 copies
8-12-71

Killinger, G. B. 1970. White Clover, Red Clover, and Ryegrass for North Central Florida. Soil and Crop Sci. Soc. of Fla. Proceedings 30:332-336. Dec. 1970.

IDAHO

The Effects of Maturity Stage on Forage Yields of Sainfoin

Wendell G. Hassell (Aberdeen)

Abstract:

Eski and Onar sainfoin, Onobrychis viciifolia, were established in 1968 on an irrigated site to determine the optimum growth stage to harvest for maximum sustaining yields. Replicated plots were harvested at three maturity stages: pre-bloom, mid-bloom, and early-pod. Yield data was collected in 1969 and 1970.

Eski cut at the early-pod stage produced the highest forage yield. An analysis of variance shows harvests at early-pod yielded significantly higher than harvests at mid-bloom and pre-bloom. Eski yields were significantly higher than Onar yields, irrespective of growth stage at harvest.

The pre-bloom and mid-bloom cutting frequencies seemed to reduce the competitiveness of the sainfoins and allowed weeds to invade. Plots clipped at early-pod appeared to resist weed invasion.

Onar commenced blooming ten days earlier in the spring then Eski. Harvesting Eski at mid-bloom seemed to have a retarding effect on flowering. Onar did not show this tendency.

***

MARYLAND

A Uniform Root Rot Test of Birdsfoot Trefoil Varieties, Strains and Synthetics

Stanley A. Ostazeski (Beltsville)

Birdsfoot trefoil (Lotus corniculatus L.) is classified as a long-lived perennial, but in the warmer parts of the United States its' habit is more nearly biennial. Lack of persistence in the species is due mainly to a complex disease of the root and crown caused by a myriad of micro-organisms interacting with numerous plant stresses and adverse environmental factors.

Recently, new varieties and synthetics have shown local differences in persistence over old-line varieties. However, these differences have usually been statistically, seldom economically, significant. Despite this fact, and because of the geographical vagariousness of the disease, a uniform root rot test was established in seven locations in the U.S. (Table 1) where trefoil is an important, or potentially useful, forage.

Two main objectives were sought. First, to determine the effective range of adaptation in selected lines used in the study which were contributed by the cooperators. Second, to compare symptoms of disease in the various locations.

Procedure: Each cooperator started plants in the greenhouse when and as he deemed necessary. At all locations, field plantings were establihed in the spring of 1970. Transplants were set in the field either barefooted, or in peat pots. At all locations the design used was a randomized complete block with six replications. Entries were set in row plots, 10 plants long, with 18 inches between plants in the row, and 24 inches between rows. At all but one location, the entire planting was overseeded with a grass appropriate to the location. During the establishment year (1970) management was minimal. During the second year, the experiment was clipped to simulate a grazing management.

Plants were dug and rated for root disease by the author at all locations during the late summer and fall of 1971. Plants were rated on the basis of 1 to 5 where 1 = plant healthy and 5 = plant dead.

Results: The gross appearance of root rot differed at Columbia, Mo., and Beltsville, Md., from all other locations. At Columbia, roots in advance stages of disease were typically hollow. The hollow rot often involved the larger lateral roots also. At Beltsville, the disease was generally confined to the upper tap root. The diseased areas were seldom hollow, were generally of deep red to dark brown color often flecked with black sclerotia of Mycoleptodiscus terrestris. Roots at all other locations were generally similar in appearance. Rotted areas were not hollow and often involved only a single wide streak of rusty red tissue. Often these streaks were present the entire length of the taproot, and sometimes were observed in the larger lateral roots.

Table 1 summarizes performance of all entries at the various locations. Note the means of the entries Md. 5A, Md. 5B, and Mo. 10 over all locations. These selections result from intensive recurrent selection programs with persistence as a primary objective. Note also the performance of PI 251146. Overall survival in this introduction was very good. Its extraordinary root rot rating over all locations suggests exploitation of this entry as a source of tolerance to root and crown disease.

The cooperation received at each location is appreciatively acknowledged.

*****

Table 1. Root rot ratings and survival percentages of birdsfoot trefoils at seven locations.

	Viking	Empire	Md. 5A	Md. 5B	Ky. Syn.	Va. 8	Va. 9	Va. 10	Dawn	Mo. 10	NY V1	NY V3	NY V9	NY V15	Iowa R1	PI 251146	Location Mean
Beltsville, Md.	43*	47	60	70	28	50	38	37	48	63	28	48	53	63	45	42	48
	2.58	2.46	1.83	2.05	3.06	2.63	2.74	2.55	2.66	2.76	3.00	2.28	2.63	2.55	2.67	2.44	2.56
Blacksburg, Va.	12	57	53	47	50	10	28	20	38	55	13	30	17	18	50	63	35
	3.33	3.03	3.25	2.95	2.75	3.50	3.08	3.47	3.55	3.07	3.47	3.50	3.15	2.94	3.47	2.48	3.19
Ithaca, N. Y.	97	85	92	97	83	88	78	77	95	90	82	70	75	92	87	87	86
	2.28	2.76	1.85	1.88	2.04	2.42	2.74	2.39	2.26	2.33	2.45	2.69	2.60	2.33	3.60	2.12	2.42
Columbia, Mo.	50	57	82	60	58	72	68	38	72	85	63	58	68	62	77	68	65
	4.13	3.68	3.69	3.64	3.63	3.88	3.85	3.88	3.77	3.71	4.00	3.91	3.98	4.03	3.85	3.44	3.82
Ames, Iowa	73	78	52	72	85	37	43	27	93	--	35	65	43	55	87	--	60
	3.86	3.45	3.71	3.77	3.00	3.73	4.27	3.69	3.52	--	4.19	4.10	3.85	4.21	3.60	--	3.78
Lexington, Ky.	55	67	90	93	80	72	50	60	70	--	67	--	--	38	57	--	67
	2.82	2.65	1.93	1.64	2.23	2.70	3.47	2.92	2.50	--	3.25	--	--	3.48	3.18	--	2.73
Raleigh, N. C.	75	45	98	95	58	73	70	--	45	80	--	--	--	--	--	70	71
	4.42	4.81	2.88	2.56	3.89	3.77	4.36	--	4.04	3.65	--	--	--	--	--	2.62	3.70
Variety Mean	58	62	75	76	63	57	54	43	66	75	48	54	51	55	67	66	
	3.35	3.19	2.73	2.64	2.94	3.23	3.50	3.15	3.19	3.10	3.39	3.30	3.24	3.26	3.40	2.62	

* At each entry and location, the upper figure is the percent survival, the lower is the root rot rating based on 1= plant healthy, and 5= plant dead.

-- Not included at this location.

MICHIGAN

Lupine Breeding in Michigan

H. L. Kohls and F. C. Elliott

In the course of our breeding work we have developed a few selections of L. angustifolius that are very low in alkaloids, and several strains of L. albus that we believe to be alkaloid free. These were fed to voles in comparison with soybean meal and casein as the only source of protein in the diet. The protein in the diet was calculated to 7%. The efficiency of the ration is expressed as V.P.I. (vole preliminary index) which is the gain in body weight of the voles divided by the protein consumed by the animals.

The data in Table 1 indicate a wide range in the feeding value not only within species but between sib strains of the same variety, such as 47-1 and 47-5, also 49-1, 49-7 and 49-9. Several strains have values as high or higher than soybean meal. One strain, 47-1, with a V.P.I. of 3.76 may be significantly above casein in feeding value as expressed by voles.

Sufficient seed of the best varieties has not been available for feeding trials with large animals. However, seed of two varieties not considered low in alkaloids was available for three trials in comparison with soybean meal as the main source of protein in the grain part of the ration.

MSU-5 with a V.P.I. of 2.68 and MSU-101 with a V.P.I. of 2.19 and soybean meal with a V.P.I. of 2.44 were fed to dairy calves.* The calves made satisfactory gains in body weight but were significantly below calves fed soybean meal.

The same two varieties were fed to mature swine.* The appetite of the pigs was depressed and feed consumption, particularly on MSU-5, nearly ceased by the end of the trial. The animals recovered quickly when changed to a corn-soybean ration.

When MSU-5 was fed to dairy cows in comparison with soybean meal as their main source of protein they consumed the lupine feed readily but the intake of hay was depressed and a corresponding reduction in milk production was noted.*

A few of the better strains will be increased as soon as possible for use in dairy cattle feeding trials. We expect to have seed of MSU-2 available for a feeding trial this fall. This variety with its very low alkaloids and other unidentified antimetabolites should give very satisfactory results.

* Dairy cattle and swine feeding trials were in cooperation with the Dairy and Animal Husbandry Departments.

Preliminary work in the greenhouse indicates that some varieties of lupines require vernalization, others do not, while some seem to be segregating for the need of vernalization. In temperatures ranging from 67° to about 80° very early varieties such as Unicrop matured in 90 days after seeding while later varieties matured in 4 to 4-1/2 months. This is very similar to the length of growing season required in the field. On this basis three generations of varieties such as Unicrop can be grown in one year, one in the field and two in the greenhouse. Later strains would be limited to one generation in the field and one in the greenhouse.

Indications are that large numbers of seedlings, about two weeks of age, can be screened for alkaloids in the greenhouse, the selections grown to maturity and then screened for other characters, such as non-shattering of seed in blue lupines. This system should increase the size of the breeding program that can be handled and decrease the time required to complete a breeding project.

Table 1. Vole preliminary indices of protein efficiency of blue lupine very low in alkaloids and alkaloid free white lupines.

	V.P.I.
Lupinus angustifolius - Blue lupines	
Borre	2.53
MSU-103	2.04
Unicrop	3.09
25-34	2.79
L. albus - White lupines	
Blanca	3.21
Sweet varieties bulked	2.29
MSU-2	2.99
47-1	3.76
47-5	2.69
49-1	3.12
49-7	2.97
49-9	2.07
Soybean meal	2.44
Casein	3.21

******

MICHIGAN

Release of 'Mackinaw' Birdsfoot Trefoil

Dorian A. Carroll (East Lansing)

Mackinaw birdsfoot trefoil, Lotus corniculatus L. has been released by the Plant Sciences Division of the Soil Conservation Service as an improved variety for use as a long-lived perennial legume with grass for pasture or hay and for use with grass for seeding earth fills, banks and on areas that are too wet for crownvetch. The attractive yellow blossoms enhance its value for critical area plantings where the objective includes beautification. Mackinaw is well adapted to soil and climatic conditions of the upper Midwest.

Origin: Mackinaw, formerly tested as M2-11348 and Mich-240 originated from Empire birdsfoot trefoil plantings in Iowa and is a production of natural selection under Iowa conditions for several generations.

Description: Mackinaw resembles Empire birdsfoot trefoil in general characteristics being a semi-prostrate, late blooming pasture type. It differs in being more vigorous in the seedling stage and higher yielding in the mature plant stage.

In row evaluation at the Rose Lake Plant Materials Center, East Lansing, Michigan, it was superior in forage production and stand persistence to New York Empire. Mackinaw has been widely tested in the USDA Uniform Legume Nurseries. Comparisons were made with Empire birdsfoot trefoil at Iowa State University, the University of Illinois, and the SCS Plant Materials Center at Elsberry, Missouri. Four years of data from the University of Wisconsin showed the improved variety Mackinaw out-yielded Empire when seeded in mixture with bromegrass on both well-drained and poorly-drained sites.

Breeder Seed: Will be maintained by the U. S. Department of Agriculture Soil Conservation Service, Rose Lake Plant Materials Center, SCS, R.#1, East Lansing, Michigan.

Site adaptation: Mackinaw birdsfoot trefoil is well suited to the less fertile soils and is productive on somewhat poorly drained soils or soils with slow or very slow internal drainage. It also has a place on fertile soils to be in permanent cover for long periods of time or in pastures that are difficult to plow or cultivate. On well-drained fertile soils the present varieties of trefoil are generally less productive for forage than alfalfa.

Seed Availability: Foundation seed of Mackinaw birdsfoot trefoil is available through the plant materials program for the establishment of a limited number of seed increase plantings for the production of Certified seed.

Further information on the establishment and management of Mackinaw birdsfoot trefoil may be obtained from Dorian A. Carroll, USDA, SCS, Room 101, 1405 South Harrison Road, East Lansing, Michigan, 48823.

******

MINNESOTA

Production of Inbred Seeds of Trifolium pratense L. by the use of Infra-red Lamps 1/

G. A. Page 2/ (Minneapolis)

Abstract

High self seed set has been obtained with the use of heat from infra-red lamps applied to the heads of normally self-incompatible red clover (Trifolium pratense L.) during anthesis. The heads with plants intact were placed under the lamps for two days when petal color was beginning to appear in the buds. Average self seeds set per head on I_0 plants was 5.9 in 1970-71 and 5.7 in 1971-72. I_1 and I_2 plants set an average of 6.8 self seeds per head in 1971-72.

In recent years considerable effort has been made to find a method of overcoming the extreme self-incompatibility of red clover, a phenomenon explained genetically by a large number of self-incompatible alleles. Occasionally a small amount of self seed is produced by a process now commonly called pseudo-self-compatibility. Very rarely a red clover plant carries a self-fertility allele (S_f allele) in place of an incompatible allele, in which case the plant readily produces seed after self-pollination. Of the various methods used in attempting to overcome self-incompatibility (growth substances, viruses, etc.) high temperature appears to be the most promising (Kendall and Taylor, 1969) 3/ (Leffel and Muntjan, 1970) 4/. Interest in the possibility of producing sufficient self seed to initiate a hybrid red clover program was provided by W. A. Kendall's high temperature, excised flower technique presented at the 1967 Red Clover Research Conference at the University of Kentucky.

Attempts to use this method with various modifications produced insufficient amounts of inbred seed for a hybrid breeding program. In the fall of 1971 an infra-red heat lamp was used over clover heads held in place by "fingers" made of 10 cm lengths of flat, plastic garden hose. The fingers were bolted together through drilled holes to a small board and attached to a vertical support by a C-clamp. Heads showing a small portion of flower color were slipped between the fingers. A 125-watt infra-red lamp was positioned approximately 55 cm above the heads or just above the point at which the heads would burn. After two days under heat the heads were rolled and the plants returned to the greenhouse. Foreign pollen contamination was avoided by rolling heads with the hand inside a plastic sandwich bag and changing the bag for each plant. At

---

1/ Contribution from Northrup, King & Co., Minneapolis, Minn., 55413.
2/ Project Leader, Hybrid Forage Crops, Northrup King & Co.
3/ Kendall, W. A. and N. L. Taylor. 1969. Effect of temperature on pseudo-self-compatibility in Trifolium pratense L. Theoretical and applied genetics 39:123-126.
4/ Leffel, R. C. and A. I. Muntjan. 1970. Pseudo-self-compatibility in red clover (Trifolium pratense L.). Crop Sci. 10:655-658.

least one seed was set in 48% of the heads with an average of 12.2 seeds per head (Table I). A multi-point temperature recorder indicated temperature differences at points as little as two centimeters apart under the lamp. Some of the fingers became too hot, pinching off the stem and causing premature death of the flower.

Attempting to correct the temperature variation and overheated fingers, in 1971-72 a series of ten 125-watt lamps was mounted in linear fashion 18 cm apart (center of lamp to center of lamp). A white peg board with slots cut every five centimeters was placed 55 cm below the lamps to hold the flowers in exact position. If the plants have a sufficient number of heads close to anthesis, it is possible to have 150 heads in these slots at once. Of the 898 heads placed in the peg board, 70% set at least one seed (Table I), indicating at least partial solution to the problems encountered during the winter of 1970-71. The plants brought into the greenhouse in the fall of 1971-72 were less vigorous than those used in 1970-71 due to a severe leafhopper attack which possibly accounts for the lower average seed set per head. Also, the seed made in 1971-72 was produced later in the winter under shorter days and more overcast skies.

Seed set in 1970-71 ranged from 0-68 seeds per head on the I_0 plants. The I_0 plants in 1971-72 set from 0-55 seeds per head. The I_1 and I_2 plants averaged 6.8 seeds for all heads and 9.0 seeds in those heads which set at least one seed, which is comparable to the 5.7 and 8.3 averages of the I_0 plants (Table I). In 1970-71 the majority (52%) of the plants produced from 6 to 35 seeds per head. There was a wide range in seed yields from heads of the same plant placed under the lamp on the same date as well as on different dates. A check was made in 1970-71 of the very high seed yielding plants for the S_f allele by rolling heads under normal greenhouse conditions. In no case did any plants produce seed. I_1 progeny produced in 1970-71 were very uniform and rarely was an outcross observed in terms of an un-uniform or vigorous plant.

One method of producing hybrid red clover is to maintain and increase by vegetative propagation the inbred parents of the double cross. If enough self seed could be obtained, it would be possible to establish inbred seed lines and plant the single cross fields from seed rather than from vegetative cuttings. It would appear less costly to produce 10-20 seeds by the described method than by making cuttings of the parental lines. The problems of maintaining red clover vegetatively would also be eliminated by the establishment of seed lines.

***

Table I.

Population	Generation	WINTER 1970-71 Plants	Heads	Avg. Seeds/ Head	Heads with Seed	Avg. Seeds/ Head	WINTER 1971-72 Plants	Heads	Avg. Seeds/ Head	Heads with Seed	Avg. Seeds/ Head
A	I_0	20	345	5.5	134	14.1	5	20	9.1	18	10.1
	I_1 & I_2						73	185	7.9	162	9.0
B	I_0	47	259	5.8	129	11.7	73	111	6.2	76	9.2
	I_1 & I_2						93	230	6.2	160	8.9
C	I_0	60	373	5.9	185	11.9	28	31	4.0	15	8.3
	I_1 & I_2						31	70	4.6	35	9.3
D	I_0	32	163	4.1	76	8.8	56	117	4.3	69	7.3
	I_1 & I_2						11	30	6.7	25	8.0
E	I_0	66	275	7.5	161	12.8	65	119	5.4	78	8.2
	I_1 & I_2						40	109	7.8	87	9.7
F	I_0						72	133	4.8	79	8.1
G	I_0						55	103	7.0	77	9.3
H	I_0						76	127	6.4	102	7.9
I	I_0						68	137	6.6	113	8.1
TOTAL	I_0	225	1415	5.9	685	12.2	498	898	5.7	627	8.3
	I_1 & I_2						248	624	6.8	469	9.0

MINNESOTA

Quackgrass Control in Birdsfoot Trefoil

G. C. Marten and R. Behrens (St. Paul)

'Kerb' (RH-315) is an experimental herbicide which has been proposed for quackgrass control in forage legumes. Our objective was to determine whether Kerb would effectively reduce or eliminate quack in birdsfoot trefoil. We applied Kerb at 3 rates (0, 2, and 4 lb/A) in 4 replications on October 15, 1969 (after first frost), and measured yields of birdsfoot trefoil and weeds during the summer of 1970. One-third of each plot received one of 3 rates of Kerb again on October 14, 1970 (0, 1, and 2 lb/A), and yields were measured in 1971.

While Kerb applied at any of the rates (1, 2, or 4 lb/A) resulted in a greater percentage of birdsfoot trefoil (Table 1), control of quackgrass was temporary, requiring repeated applications to be effective. Also, less quack after Kerb application was usually accompanied by invasion of more broadleaf weeds.

Weed-free yields of birdsfoot trefoil were 1.7, 2.4, and 2.6 T/A (different at $P < .05$) with Kerb rates of 0, 2, and 4 lb/A, respectively in 1970. However, yields of total herbage dry matter (birdsfoot trefoil plus weeds) did not differ among treatments (3.4 or 3.5 T/A).

In 1971, weed free yields of birdsfoot trefoil were identical across Kerb levels (1.8 T/A). Yields of total herbage dry matter decreased progressively with increased levels of Kerb (3.2, 2.9, and 2.4 T/A with Kerb rates of 0, 1, and 2 lb/A, respectively). Thus, while Kerb temporarily reduced quackgrass invasion, it ultimately reduced total forage yields. However, damage to birdsfoot trefoil was obvious only at the 4 lb rate at the first harvest of 1970.

***

Table 1. Botanical composition of birdsfoot trefoil-weeds mixture when 3 levels of 'Kerb' were applied in late fall over a two-year period. 1/

Species	Kerb level (lb/A), 1970 harvests 2/			Average over all levels of 1970
	0	2	4	
Birdsfoot trefoil	49 c	71 b	76 a	
Quackgrass	44 a	17 b	4 c	
Broadleaf weeds	7 c	12 b	20 a	
Total	100	100	100	

	Kerb level (lb/A), 1971 harvests 3/											
	0	1	2	0	1	2	0	1	2	0	1	2
Birdsfoot trefoil	60	63	74	55	59	72	56	65	74	57 c	63 b	74 a
Quackgrass	33	26	12	40	30	17	37	22	8	36 a	26 b	12 c
Broadleaf weeds	7	11	14	5	11	11	7	13	18	7 b	11 ab	14 a
Total	100	100	100	100	100	100	100	100	100	100	100	100

1/ % of total DM: figures within a row followed by different letters are different at the 5% level.

2/ Average of 3 harvests.

3/ Average of 2 harvests.

MINNESOTA

Forage yields of birdsfoot trefoil and red clover varieties

Arne Hovin (St. Paul)

Table 1. Birdsfoot Trefoil Variety Trial. Rosemount, Minn. Seeded 1967. 4 reps. Plot size 6 x 20 ft.

Variety	Minn. Seed Lot No.	Forage yield (T/A, 15% moisture) 1967*	1968	1969	1970	3-year average 68-70
Leo	9702	1.31	4.16	4.09	3.29	3.85
MC-H	9701	1.38	4.14	4.37	3.60	4.04
Dawn	9706	1.09	3.94	4.19	2.93	3.69
Empire	9705	.59	3.68	3.79	2.73	3.40
Iowa E-1	9708	1.09	3.52	2.93	2.50	2.98
Iowa R-1	9707	1.36	4.16	4.43	3.04	3.88
MO-10	9709	1.43	3.51	4.03	3.16	3.57
Viking	9704	.88	1.45	3.96	3.18	2.86
Mansfield	9703	1.23	--	1.86	3.10	2.48**
MO-110	9710	1.18	--	1.93	2.71	2.32**
LSD 5%		.33	.61	.58	.35	.51

* One harvest, year of seeding.
** 1969-1970.

Table 2. Birdsfoot Trefoil Variety Trial. Rosemount. Seeded 1968.

Variety	Minn. Seed Lot No.	Forage yield (T/A, 15% moisture) 1969	1970
Dawn	9801	3.44	3.75
Empire	9803	3.24	3.57
Leo	9802	3.59	3.98
NK (N6-128)	9805	3.34	3.52
Viking	9804	3.56	3.95
LSD 5%		.34	.45

Table 3. Medium Red Clover Variety Trial. Rosemount, Minn. Seeded 1968. 4 reps. Plot size 6 x 20 ft.

Variety	Minn. Seed Lot No.	Forage yield (T/A, 15% moisture) 1969	1970*
Dollard	6805	4.20	1.78
Lakeland	6806	4.35	2.04
Medium	6802	4.43	1.51
PAC	6701	4.48	1.85
Rea	6602	4.29	1.82
Minn. Sel.	6801	4.66	2.02
Minn. Tet. Sel.	6807	4.31	1.70
Common	6804	5.04	1.66
LSD 5%		NS	NS

* One cut, second crop harvested for seed.

Table 4. Forage yields (tons/acre) (5% moisture) of birdsfoot trefoil varieties in Minnesota.

Variety	Crookston		Grand Rapids	Lamberton	Rosemount				Waseca
	1966	1968-69	1968-69	1968-69	1966[1]	1967[2]	1968-70	1970	1968
Dawn	--	3.50	2.41	2.33	--	1.09	3.69	3.75	3.11
Empire	2.45	3.50	2.31	2.38	0.68	0.59	3.40	3.57	3.01
Leo	3.06	3.55	3.04	3.40	1.27	1.31	3.85	3.98	4.02
Mansfield	--	3.03	3.18	2.67[3]	--	1.23	2.48	--	2.73
Viking	2.38	3.06	2.67	3.06[3]	1.20	0.88	2.86	3.97	3.17
MC-H	2.56	3.75	2.89	3.06	1.18	1.38	4.04	--	3.65
Iowa-R1	--	4.23	2.47	3.12	--	1.36	3.88	--	
Iowa-E1	--	--	--	--	--	1.09	2.98	--	
Mo-10	--	--	--	--	--	1.43	3.67	--	
Mo-110	--	--	--	--	--	1.18	2.32	--	
LSD 5%		.45	.45	.56		.33	.51	.45	.49

1 One harvest

2 Seeding year, one harvest

3 Yields for 1969

MISSISSIPPI

Selected Red and White Clovers Managed as Annuals and Compared to Annual Trifolium Species

William E. Knight (State College)

Since the introduction of the arrowleaf clovers (Trifolium vesiculosum) yield comparisons have been made throughout the region between crimson and the arrowleaf clovers. First results with arrowleaf clover were erratic and irregular stands were frequently obtained. Fall growth was difficult to obtain the establishment year when planted at the recommended time for crimson clover. Based on recent research, it is now possible to obtain excellent fall production from the arrowleaf clovers. This has been made possible by recognition of (1) the requirement for a specific inoculant, (2) the necessity for seed scarification, and (3) the presence of two dormancy factors inhibiting germination.

Arrowleaf clover may contain in excess of 80% hard seed after combining. Scarification enables many impermeable seed to germinate readily. Arrowleaf clover also has a high level of high temperature induced dormancy. Planting under high temperature conditions causes many seeds to imbibe moisture but germination will not take place because of high temperature dormancy. When lower temperatures occur, germiantion begins but it is erratic. Planting scarified seed that has been inoculated with an effective culture greatly enhances establishment and results in fall growth of this species. Best results are obtained if planting is done during cool, wet weather since the high temperature dormancy mechanism may prevent scarified seed from germinating immediately and cause uneven stands.

Some locations in the region continue to recommend late planting to avoid some of the pitfalls described above. This practice introduces a bias into tests where species are compared since late planting (Nov. 1) of crimson clover may reduce total yields in excess of 50%. The arrowleaf clovers mature late and late planting does not reduce total yields of this species. However, late planting usually precludes fall production of both species in most seasons. A comparison of arrowleaf with crimson does not appear to be valid since crimson clover reaches full bloom in late April and arrowleaf reaches full bloom in late May or June.

Amclo, Meechee and Yuchi arrowleaf varieties were planted in a randomized block experiment at State College, Mississippi at two locations. Chief and Frontier crimson and Bacchus Marsh, Mississippi Ecotype, and Mt. Barker sub clovers were other annual clovers included in the test. Orbit red clover and Regal white clover were included to compare with summer production of arrowleaf clover.

The test was planted on August 20, 1969 in 6 replications with plot size 6' x 12'. Forage yields were taken when growth reached 6 to 8 inches and harvests were made with a rotary mower set to cut at 3".

Results:

Crimson and arrowleaf clovers were the most productive species during the fall and winter (Table 1). Crimson clovers produced more winter forage than the arrowleaf clovers and were more winter hardy than the arrowleaf varieties Amclo and Yuchi. An effort was made to harvest the annual species at their peak of growth in the spring. Thus, the full bloom harvest was variable. The arrowleaf clovers were harvested on May 7, since dry weather was causing loss of leaves. These varieties were harvested before serious losses had occurred, however, there was no regrowth on the arrowleaf varieties following the May 7, 1970 harvest. Orbit and Regal continued to grow throughout the summer. These plots were in excellent condition when the August harvest was made and would have produced well for another season without reseeding.

It may be both economical and practical to use perennial species as annuals when seed of annuals is unavailable or prices are prohibitive. This practice would permit maximum utilization of forage production without consideration of management for stand longevitiy or persistence.

Preliminary evaluation of 47 annual Trifolium introductions from Israel and Australia indicates wide variations for morphology, maturity, and disease reaction. These accessions should prove to be valuable germplasm sources in developing varieties of sub clover adapted to the Southeast. Major emphasis will be placed on T. subterraneum since this species is believed to have great potential in improving much of the acreage devoted to grassland agriculture in Mississippi and the Southeast. Thirteen commercially available sub clover cultivars have been established in ryegrass, fescue, and alone. Some of these cultivars appear to be adapted in their present state and are more productive than a Mississippi Ecotype, however, four of the cultivars lack winter hardiness.

Regional evaluation of crimson clover double-cross hybrids indicates that inbreeding and hybridization can be used effectively to produce crimson clover hybrids for commercial production.

Recurrent selection against seed losses from lodging and shattering has produced lines with resistance to lodging and shattering. These lines are being evaluated via the polycross method and superior shatter resistant lines will be recombined.

Publications:

1. Knight, W. E. 1970. Tibbee: a new reseeding variety of crimson clover. Miss. Agric. Exp. Info. Sheet 1131.

2. Knight, W. E. 1971. Influence of spring mowing on reseeding and productivity of selected annual clovers. Agron. J. 63:418-420.

3. Knight, W. E. 1971. Productivity and yield distribution of selected red and white clovers managed as annuals and compared to annual Trifolium species. 68th Proc. Assoc. So. Agric. Workers.

4. Knight, W. E. 1971. Productivity and yield distribution of selected red and white clovers managed as annuals. Miss. Agric. Exp. Sta. Info. Sheet 1150.

5. Knight, W. E. 1971. Station tests grass-clover-combinations. Miss. Farm Res. 34: No. 6.

6. Knight, W. E. and H. S. Lee. 1971. Inheritance of variegated flower color in crimson clover. Agron. Absts.

7. Sullivan, S. L., W. E. Knight, and K. P. Baetcke. Genetic and chemical studies of anthocyanin pigmentation in crimson clover, Trifolium incarnatum L. Agron. Absts.

8. Knight, W. E. 1972. Registration of Tibbee crimson clover. Crop Sci. 12:126.

9. Sullivan, S. L., K. P. Baetcke and W. E. Knight. 1972. Anthocyanins of color mutants of crimson clover (Trifolium incarnatum). Phytochem. (In press).

Table 1. Dry forage yields from selected annual and perennial clovers grown at State College, Mississippi.

	Time of harvest and forage yield in lbs. DM per acre					
	Fall & Winter	Full Bloom	6-8-70	7-10-70	8-27-70	Total
Chief CC	1356	4235[2/]	--	--	--	5591
Frontier CC	1699	4552[1/]	--	--	--	6251
Amclo AC	1274	4512[3/]	--	--	--	5786
Meechee AC	1182	4764[3/]	--	--	--	5946
Yuchi AC	1517	4574[3/]	--	--	--	6091
Bacchus Marsh SC	587	3507	--	--	--	4094
Miss. Ecotype SC	555	3672	--	--	--	4227
Mr. Barker SC	748	4116	--	--	--	4864
Orbit RC	649	4647[3/]	3654	1976	1405	12331
Regal WC	585	2989[3/]	2091	1474	1898	9037
Ball Clover	779	3913[2/]	--	--	--	4692
LSD .05	120	1040	--	--	--	920
CV %	15.9	21.7	--	--	--	12.3

* Winter injury 1-10; 1 = best
** Stand 1-10; 1 = best
*** Vigor 1-10; 1 = best

1/ Cut 4-22
2/ Cut 4-28
3/ Cut 5-7

MISSOURI

Establishment of Crownvetch and Trefoil in Dead Litter Mulch

B. H. Roundtree [1/]
and
D. C. Smith [2/]

(Elsberry)

PROJECT #42 - ESTABLISHMENT OF CROWNVETCH AND TREFOIL IN DEAD LITTER MULCH.

OBJECTIVE: To determine the differences in establishment of selected grass and legume species on clean seedbed versus dead litter seedlings.

SPECIES USED: 'Emerald' crownvetch - Coronilla varia; birdsfoot trefoil - Lotus corniculatus; 'Blackwell' switchgrass - Panicum virgatum; prostrate lespedeza - Lespedeza daurica schimadae.

SEEDING DATES: September 30, January 30, and April 30.

SEEDING RATES: Seed used in these plots was harvested in 1964 and succeeding years.

Acc. No. & Name	Seeding Rates per/acre	Purity	Germination	Date Tested
M2-10215-64 (hulled) crownvetch	10#	99.48%	86%	11/64
M2-10215-64 (unhulled) crownvetch		No germination test		
M1-5714-64 'Blackwell' switchgrass	10#	99.77%	95%	10/65
M2-11348-64 birdsfoot trefoil	5#	99.62%	92.00%	10/65
M-4944-64 prostrate lespedeza	20#	99.54%	91.65%	10/65

FERTILIZATION: None

SOILS:

662 - Light colored, deep well drained, medium textured soils slightly acid to neutral silty subsoil. Similar soil Nodaway, Sharon, Huntington, Haynie, Robinsonville, Linside and Ashton.

Soil test information:

OM	P_h	Phosphate P_2O5	Potassium K_2O	Mg
1.3	6.5	300	170	190

671 - Light colored, deep, imperfectly drained, medium textured soil with medium acid silty subsoil similar soil Westerville, Humeston, Belknap, Wakeland, Coffeen, Mewark, Commerce, Falaya and Coppock.

Soil test information:

OM	P_h	Phosphate P_2O5	Potassium K_2O	Mg
2.2	6.5	lbs./ac. 294	130	280

METHOD OF SEEDING: Broadcast on surface.

LENGTH OF EVALUATION: 3 years

SEEDBED PREPARATION: Plots 60' x 15'. In June, all plots plowed and disked. Field divided in half leaving plots 30' x 15'. One-half was seeded to sudangrass with drill at rate of 30# seed per/acre. The other half of field was plowed and fallowed through the growing season. As sudangrass reached bloom (about 6') it was mowed with sickle mower and allowed to fall on ground surface. None of the forage was removed nor was the plot plowed or disked. The plow fallow part of the plots were disked as often as necessary to control weeds. Seed was broadcast on litter and on surface of soil on three different dates - Sept. 30, Jan. 30, and April 30.

RESULTS: In all planting dates trefoil and crownvetch established at least one year earlier on sudan mulched areas. September - December plantings established sooner than the April planting date on both kinds of seedbed.

Switchgrass and prostrate lespedeza were much slower to establish than crownvetch or trefoil.

Stand counts were made in October on plots planted to trefoil and crownvetch the previous Sept. 30, Dec. 30, and April 30. Following are the counts --

On mulched trefoil	-	63 plants per sq. ft.
On mulched crownvetch	-	52 " " " "
On plow fallowed crownvetch	-	12 " " " "

These counts were made in October following plantings made Sept. 30, Dec. 30, and April 30 of the previous season. (This would be 12 months after fall seeding, nine months after winter, and six months after spring seeding).

The least difference in mulch-fallowed plantings occurred in the April 30 seeding. The most impressive contrast was in plant development the first year. Plants on mulched areas had 1-1/2 to 3' crown spread. On plow fallow areas most all plants were only in the one to three leaf stage and none had more than a 4" crown spread. By the end of the second growing season, there was an excellent stand in the sudan mulched plots and a good stand in the plow fallow areas. Ground cover was complete in the mulched areas with only a few weeds present. In the plow fallow areas, ground cover was not complete and weeds still dominated the plots. By the end of the third growing season, there was no appreciable difference in ground cover and vigor of crownvetch, trefoil plots, but, scattered weeds still occurred in the plow fallow area.

CONCLUSIONS:

1. At Elsberry, crownvetch and birdsfoot trefoil seeded on sudan mulch established one year earlier than on a clean tilled seedbed.

2. Seedling stand counts were 4 to 10 times greater the first season on mulched plots and growth on the mulched area was estimated as 20 times that on the clean tilled seedbed.

3. Weeds were a serious problem on plow fallow areas through the third growing season. (Weeds and grassy weeds are a serious deterrent to establishment at Elsberry).

4. Successful plantings of crownvetch and trefoil can be made on dead sudangrass litter in Sept., Jan., or April. (This spreads seeding time.)

5. To date, the quickest way to establish crownvetch and trefoil at the Elsberry PMC without the use of chemicals for weed control is to surface plant on dead litter of sudangrass.

6. This method of planting did not give satisfactory stands of switchgrass and prostrate lespedeza. Planting in a dead litter with a double disk furrow opener drill has given good results in other regions and should be investigated here.

7. The depressant effect on the heavy sudan litter (3-6 tons) on weeds and weedy grasses enabled the trefoil and crownvetch to get about 4-6 weeks jump on annual competitive weed growth. This gave the legume plantings a distinct advantage.

8. The dead litter also provided a more favorable condition for seed germination and seedling growth.

1/ Field Plant Materials Specialist, Illinois, Iowa, and Missouri.
2/ Center Manager, Plant Materials Center, Elsberry, Missouri.

***

NEBRASKA

Clover Investigations at Lincoln

H. J. Gorz, F. A. Haskins, and G. R. Manglitz (Lincoln)

In a third-year stand of 10 red clover varieties and strains that were heavily infested with larvae of the clover leaf weevil (Hypera punctata Fab.), data obtained on June 11, 1971 indicated that Mammoth, Lakeland, Dollard, and LaSalle were highly resistant to feeding by this insect while Kenland, Nebraska Common, and Penscott were highly susceptible. Ky. Syn A-3, Ky. Syn A-2, and Chesapeake were intermediate. Data are presented in Table 1. The correlation coefficient between percent defoliation and score for weevil reaction was 0.975**, between score for weevil reaction and forage yield was 0.946**, and between forage yield and percent defoliation was 0.915**. Although only a single year's data is available, it appears that present varieties of red clover do differ significantly in their reaction to feeding by larvae of the clover leaf weevil.

A wide range of red clover germplasm was screened for resistance to the yellow clover aphid (Therioaphis trifolii (Monell)), the pea aphid (Acyrthosiphum pisum (Harris)), and the clover aphid (Nearctaphis bakeri (Cowen)) by mass infesting young seedlings grown in a greenhouse. The level of resistance to the clover aphid and the yellow clover aphid was low in the unselected germplasm while resistance to the pea aphid was more readily available. The percentage of plants surviving yellow clover aphid infestation was increased from an average of 4% for the unselected germplasm to 34% after one cycle of selection and 75% after two cycles of selection. The average reaction score (in which the lowest number designates the highest level of resistance) was decreased by 13.9% after one cycle and 38.5% after two cycles of selection. Resistance to the pea aphid was increased substantially after one cycle of selection when pea aphids collected and propagated on red clover were used. Plants having combined resistance to the yellow clover aphid and pea aphid have been identified and propagated.

High- and low-coumarin lines of sweetclover from seven different groups of germplasm were screened in the greenhouse for resistance to the sweetclover aphid (Therioaphis riehmi (Börner)). A total of 552 resistant plants were selected from an initial stand of 8949 seedlings grown from 233 different lines.

In a study of the effect of temperature on nitrate content in Goldtop sweetclover, contents were significantly higher at 80°F for all leaf stages sampled, when compared to a temperature of 60°F. Nitrogen fertilizer applied to Goldtop sweetclover prior to seeding increased the content of nitrate in the leaves but differences between two different nitrogen fertilizers were nonsignificant. Studies of the relationship between nitrate content and nitrate reductase activity have been initiated.

Species of Melilotus differed in the amount of damage sustained by the sweetclover root borer. Plants high in coumarin content had significantly more larvae per plant than low-coumarin plants.

Four species of blister beetles (Epicauta spp.) fed preferentially on Melilotus plants low in content of o-hydroxycinnamic acid (o-HCA). In high-o-HCA plants, beetle feeding was strongly deterred by either cis-o-HCA glucoside or coumarin; the presence of both compounds eliminated virtually all feeding. Trans-o-HCA glucoside had no significant deterring effect.

In sweetclover leaf or bean hypocotyl homogenates, β-glucosidase activitty was found primarily in the supernatant fraction at pH 8.5, but at pH 5.0, the pellet accounted for most of the activity. Activity in such pellets was solubilized by suspending the pellet in sodium chloride solution or in pH 8.5 buffer. Thus, it appears that β-glycosidase may be reversibly shifted between pellet and supernatant fractions by varying the pH of the suspending medium. pH was the critical factor in determining β-glucosidase solubility; cellular debris had no effect on the distribution pattern.

Two simply inherited characters, o-hydroxycinnamic acid (o-HCA) content and β-glucosidase activity, were used as genetic markers in studying the frequency of cross-fertilization in M. alba. Based on the o-HCA marker, cross-fertilization averaged 58% for 2 harvest years in a biennial population and 67% in a 1-year study with an annual population. Use of the β-glucosidase marker provided an estimate of 72% crossing in a biennial population.

In a study of the inheritance of seed color in M. alba, two independent pairs of alleles were postulated to explain the eight seed color and 2 stem color phenotypes obtained. The C/c alleles control flavonoid synthesis in the seed coat as well as anthocyanin synthesis in the seedling plants. The recessive homozygote lacks at least two specific flavonoids and one anthocyanin which are found in plants having a dominant allele. The Y/y alleles apparently affect the absence or presence of chlorophyll in the seed.

In studies of sweetclover tissue cultures, no differences were found between the various basal media used. The most effective growth factor in inducing and maintaining callus was 2,4-D. Small roots were produced by callus cultures when the concentration of 2,4-D was decreased, but no buds have been produced to date.

The inheritance of 6 leaf-color mutants, 2 stem-structure mutants, 3 deformed-leaf mutants and 1 dwarf mutant is being studied. Most of the mutants are conditioned by a single recessive gene. Linkage has been observed between the genes controlling multifoliolate leaves and elongated stem. The allelism of the 6 leaf-color mutants with previously studied mutants of the same type is being investigated.

Various purines and pyrimidines and their derivatives were tested for their influence on sweetclover weevil feeding. At a concentration of 0.01M, adenosine and sucrose were about equal in feeding stimulant activity, but as the concentration was decreased, adenosine had increasingly greater feeding stimulant activity when compared to sucrose. Additional work has been done to isolate and identify Deterrent A.

Publications:

1. Gorz, H. J., and F. A. Haskins. 1971. Evaluation of cross fertilization in forage crops. Crop Science 11:731-734.

2. Gorz, H. J., and F. A. Haskins. 1971. Cross-fertilization in Melilotus alba. Crop Science 11:767-768.

3. Manglitz, G. R., H. J. Gorz, and H. J. Stevens, Jr. 1971. Biology of the sweetclover root borer. J. Econ. Entomol. 64:1154-1158.

4. Manglitz, G. R., H. J. Gorz, and F. A. Haskins. 1971. Resistance to the sweetclover root borer as influenced by species and coumarin content. Spec. Reprt. X-324, Ent. Res. Div., ARS, USDA, 8 pp.

5. Gorz, H. J., F. A. Haskins, and G. R. Manglitz. 1971. Blister beetles: Effect of o-hydroxycinnamic acid on feeding preferences in Melilotus plants. Spec. Reprt. X-327, Ent. Res. Div., ARS, USDA, 7 pp.

6. Jaynes, T. A., F. A. Haskins, and H. J. Gorz. 1972. Oxidation of phenylpyruvate by sweetclover peroxidase. Phytochemistry 11:563-569.

7. Jaynes, T. A., F. A. Haskins, H. J. Gorz, and A. Kleinhofs. 1972. Solubility of β-glucosidase in homogenates of sweetclover leaves and bean hypocotyls. Plant Physiol. 49:277-279.

8. Haskins, F. A., H. J. Gorz, and R. C. Leffel. Form and level of coumarin in deer's tongue, Trilisa odoratissima. Economic Botany (in press).

***

Table 1.--Third-year performance for the first cutting (6/11/72) of 10 varieties and strains of red clover following a period of heavy feeding by clover leaf weevil larvae, Hypera punctata Fab.[1/].

Variety or strain	Source of seed	Percent stand[2/] 6/11/71	Height (cm) 6/11/71	Percent defoliation[3/]	Reaction to weevil[4/5/]	Forage production[5/] (Kg DM/ha)	% dry weight	% N
Mammoth	F.C. 39,971	92	75	5.0	2.0 a	6306 a	19.4	2.57
Lakeland	F.C. 39,989	97	71	5.0	2.0 a	6059 ab	19.8	2.33
Dollard	F.C. 39,779	91	68	5.0	2.0 a	5762 abc	19.7	2.41
LaSalle	F.C. 39,494	89	65	5.0	2.0 a	5538 abcd	21.0	2.61
Ky Syn A-3	F.C. 39,818	95	64	38.8	4.3 bc	4736 abcd	20.4	2.36
Ky Syn A-2	F.C. 39,819	90	58	60.0	4.5 bc	4361 abcd	22.3	2.45
Chesapeake	F.C. 39,970	94	60	31.3	3.8 b	4142 bcd	21.3	2.47
Kenland	F.C. 39,972	92	62	63.8	4.8 c	3570 cd	20.4	2.39
Nebr. Common	Miller Seed Co.	90	58	57.5	5.0 c	3487 d	19.8	2.59
Pennscott	F.C. 39,991	89	57	51.3	4.8 c	3352 d	21.2	2.33
	Mean	92	64	32.3	3.5	4731	20.5	2.45

1/ Averages of four replications.
2/ Calculated from approximate measurements of missing portions of harvested rows.
3/ Estimated visually for each plot.
4/ Visual scale from 1 to 5 (1 = no observable feeding; 5 = nearly complete defoliation).
5/ Means having the same letter do not differ at P = 0.01 according to Duncan's Multiple Range Test.

NEW YORK

Insects of Birdsfoot trefoil, Lotus corniculatus L.

George G. Gyrisco (Cornell U., Ithaca)

I am enclosing a list of insects of birdsfoot trefoil found in New York. I have starred those that most frequently cause us problems. The list of insects is not complete.

HOMOPTERA
  Cercopidae
    *Philaenus spumarius L.

  Cicadellidae
    Aphorodes costata (Panzer)
    Scaphytopius sp. prob. acutus Say
    Athysannus argentatus (F.)
    Agallia quadripunctata (Prov.)
    *Empoasca fabae Harris

  Aphididae
    Acyrthosiphon pisi (Harris)

HEMIPTERA
  Miridae
    *Adelphocoris lineolatus (Goeze)
    *Adelphocoris rapidus (Say)
    Plagiognathus politus (Uhler)
    Plagiognathus chrysanthemi (Wolff)
    *Lygus lineolaris (P. de B.)

  Anthocoridae
    Orius insidiosus (Say)

  Nabidae
    Nabis ferus (L.)
    Nabis subcoleoptratus (Kirby)

  Pentatomidae
    *Euschistus variolaris (P. de B.)

ORTHOPTERA
  Locutidae
    *Melanoplus femur-rubrum (Deg)
    *Melanoplus bivittatus (Say)
    *Melanoplus diffentialis (Thos.)

  Gryllidae
    *Nemobius fasciatus fasciatus (Deg)
    Acheta assimilis (F)

THYSANOPTERA
  Thripidae
    *Frankliniella tritici (Fitch)

Aeolotripidae
Aeolothrips fasciatus (L.)

COLEOPTERA
Nitidulidae
**Brachypterolus pulicarius* L.

Curculionidae
**Brachyrhinus ligustici* (L.)

Coccinellidae
Adelia bipunctata (L.)

LEPIDOPTERA
Torticidae
**Archips rosaceana* (Harr.)
**Sparganothis sulphurana* (F.)
**Tortrix pallorana* (Robn.)
**Tortrix velutiana* (Wlkr)

Noctuidae
**Plathypena scabra* (F)

DIPTERA
Larvaevoridae
Actia interrupta Curr.

Bombyllidae
Villa sp.

Syrphidae
Mesograpta marginata (Say)
Sphaerophoria cylindrica (Say)
Sphaerophoria menthastri (L.)

HYMENOPTERA
Eurytomidae
**Bruchophagus kolobovae* (Fed)

Eupelmidae
Eupelmella vesicularis (Retz.)

Pteromalidae
Amblymerus sp.
Megachile mendica Cress.

---

* Important pest species

Neunzig, H. H., and George G. Gyrisco. 1955. Some insects injurious to birdsfoot trefoil in New York. J. Econ. Entomol. 48(4):447-450.

Severe cut-backs in funds for research during the past 5 years has meant that our project on "A study of the destructive insects of birdsfoot trefoil raised for seed and forage" has been placed in the inactive status. However I maintain my cooperation and interest by working with Dr. George B. MacCollom of the Vermont Agricultural Experiment Station and with the Champlain Valley Seed Grower Association of Westport, New York.

During the past year through correspondence and one joint meeting in Vermont, we initiated clearance of several pesticides for our seed growers. There are, at present, no insecticides or herbicides that have federal registration for use on established birdsfoot trefoil grown for forage or for seed.

At present the following label has been requested for dalapon for the control of grassy weeds during the production of birdsfoot trefoil seed. Quack grass is a noxious weed in New York, and in fact one of the worst weeds of northern United States. It is particularly common throughout the birdsfoot trefoil production areas of New York and Vermont. Requests have been submitted to EPA for a state label as follows for dalapon.

> "Birdsfoot trefoil, seed production only. Dosage up to 3.7 lbs./acre. For use in Vermont and New York States. Apply in fall or early spring when clovers and grasses are 4-6 inches tall. Do not graze treated fields to livestock or feed forage, hay or seed chaff."

This addition would be made to the present label uses for dalapon. It is reasonable and justified, I feel.

Since most of our seed growers do not feed forage, hay or seed chaff of birdsfoot trefoil but are largely growers of seed, I cannot see any problems associated with this label extension for birdsfoot trefoil seed.

In addition to dalapon, New York and Vermont have requested through IR-4 that labels now valid on alfalfa used for forage be extended to cover birdsfoot trefoil being grown for seed for the following insecticides; methoxychlor, Dylox, malathion and methyl parathion. These four insecticides would enable us to control the principle destructive insect pests that include 5 species of Mirids on the flowers, buds, and developing seeds; cutworms; and the leafrollers, Spargnathos putmanans (Freeman) and Stomopteryx spp.) the meadow spittlebug; potato leafhopper; pea aphid; lesser clover leaf weevil; and grasshoppers plus field crickets on drying seed pods.

We have chosen those insecticides that have the greatest potential for our total insect complex on birdsfoot trefoil, and the least hazard to non-target organisms or dairy cattle when used according to their label for use on forage. In most cases, malathion, methoxychlor, and Dylox will do the job and in only rare instances would methyl parathion be needed.

***

NEW YORK

Crownvetch Defoliant Trials

S. I. Dronen and R. L. Sherman (Big Flats)

The indeterminate growth characteristics of crownvetch create problems for both seed production and seed harvest. Cool temperatures and high rainfall during August will cause crownvetch to start vegetative growth again. This regrowth covers the seed pods, keeping them shaded and moist. These conditions prevent seed from maturing. Excessive herbaceous growth just prior to seed harvest also causes problems for direct-combining. The green growth not only adds to the volume of material which must pass through the combine, but also makes it difficult to separate seed from the leaves, adding to the bulk of the harvested material. The green, succulent leaves also increase the moisture content and create more problems for drying.

Regrowth can be eliminated with chemical defoliants. The 1968, 1969 and 1970 annual reports indicate the work that has been done during these years with defoliants and desiccants. Two chemicals, paraquat and diquat, were used as defoliants in 1971. Rates of 1 pt/acre and 1 qt/acre of each chemical were used. They were applied on a cloudy day that had rain showers. Paraquat was more effective than the diquat. However, the 1/qt ac rate of paraquat, applied during cloudy weather, was not as effective as 1 pt/ac applied on the production field on a sunny day. All chemicals were applied with a ground sprayer. A wetting agent was used with each chemical.

The effectiveness of both paraquat and diquat are determined by weather conditions. The application of 1 pt/ac of either chemical, on a sunny day, is sufficient to stop growth. Within 3 to 5 days crownvetch is easy to combine. When the chemical is applied on a rainy day, 1 quart or more/ac may be necessary, to do a satisfactory job of defoliation. Paraquat has been the most effective on rainy days. Rates as high as 2 qt/ac of both chemicals were tried in 1969, without hindering seed germination.

Summary: The main advantages of using chemical defoliants are: faster and easier combining, less bulk material, and harvested material with a lower moisture percentage. The main disadvantage is the added production cost. There is also some crownvetch lost during the spraying application, when the defoliant is applied with a ground sprayer. The decision to defoliate has to be made about one week ahead of the date one starts combining. Too early an application of the defoliant will cause the immature seed to dry and not mature.

The problem of regrowth is not as serious on thin, well-drained upland soils. These soils should be the first choice in selecting a site for seed production fields of crownvetch. On these soils it may be necessary to defoliate for straight-combining on occasions when weather conditions are such as to cause excessive regrowth. On heavier bottomland soils, the problem of excess regrowth will occur more frequently.

***

NEW YORK

'Lathco' Flatpea, Lathyrus sylvestris L.

J. L. McWilliams and S. I. Dronen (Big Flats)

Lathco flatpea is an outstanding conservation cover plant. It is a long-lived perennial, rhizomatous legume, with a broad soil adaptation. Its rose-colored flowers bloom from mid-June to mid-August, making it an attractive as well as an effective ground cover plant. Viny, tendril-bearing stems form a dense growth 2 to 3 feet thick, but occasionally they will climb to 6 feet, if support is available.

This plant originated from a field collection in a meadow near Chehalis, Washington, and was field tested as NY-1157. Lathco is a direct increase from a small block of this field collection, planted on the Big Flats Plant Materials Center in 1958. It will be jointly released by the Soil Conservation Service and the New York and Pennsylvania Agricultural Experiment Stations, in 1972.

Lathco flatpea has been tested on various sites from West Virginia to Maine. The results of these plantings show it to be useful as a conservation plant. Spreading stems and rhizomes make it an ideal plant for protective cover on critical sites such as: roadbanks, dams, borrow areas, gravel pits, logging roads, mine spoils, and utility lines. On logging roads and similar sites, it helps to retard reinvasion of woody plants. The viny growth overtops most woody plant seedlings and shades them out. However, it will not prevent all woody plant invasion. In forested areas, where it is desirable to maintain open areas for wildlife, and clearings for esthetic value, flatpea will help maintain this condition.

Lathco flatpea is adapted to a wide variety of soil conditions. Its deep root system and ability to fix nitrogen make it well adapted to droughty, infertile sites such as sands, gravels and shales. It is not adapted to poorly drained sites, although it will grow on moderately well-drained soils. Best growth is on soils with a pH of 5.5 or higher.

A limited amount of seed will be available on the commercial market in the fall of 1972.

***

NORTH CAROLINA

Forage Potential of Peanut Introductions in North Carolina

Will A. Cope (Raleigh)

A number of peanut species have been collected in South America and grown in North Carolina by Dr. Walton C. Gregory. Under native conditions in South America certain of the species grow well in mixtures with common grasses and apparently make a significant contribution to the forage production of such mixtures. Observations by Dr. Gregory prompted him to make some of his materials available to the forage breeding program.

Most of the perennial collections arenot cold hardy here and produce only a few seed. Certain of the annual species have good seed production and good vigor under cultivation. One such species, Arachis monticola Krapovichor and Rigoni, appears to have enough vigor and reseeding capability to warrant preliminary tests for forage potential in the Coastal Plain.

Seedlings were established in the greenhouse and transplanted on June 1, 1970. Two seedlings were established in soil bins 4' x 8' in size. Four replications of three treatments were made. Treatments were: (1) No companion grass, (2) dallisgrass, Paspalum dilatatum, and (3) 'Wilmington' bahiagrass, P. notatum. An excellent stand of bahiagrass was obtained, while the stand of dallisgrass was quite thin and probably gave the peanuts no competition in either of the two years of the test. The peanuts grew slowly at first, but with irrigation became quite vigorous in midsummer. Many peanut branches grew outside the 4' x 4' space to which a plant was alloted. Most of the peanut plants flowered well in late summer and fall. The pegs penetrated the soil well where there was little sod. Few pegs penetrated the bahia sod.

Seedling stand counts were made at two dates in 1971. Seedling emergence was slow with most emerging in late May, Table 1. Where there was little or no grass sod, a fair stand of peanut seedlings was eventually established. There were very few seedlings in the heavy bahiagrass sod. Growth of the seedlings during the summer was relatively slow, and growth was never as good as in the previous year. Periodic mowing to simulate light grazing apparently contributed to the lack of vigor and attainment of a good cover in 1971.

Arachis monticola does not appear to be adapted for forage use in the Coastal Plain of North Carolina. The late seedling emergence, the lack of early season vigor, and the failure to reseed under a good sod would severely limit its production and persistence. Selective grazing would probably eliminate stands quickly.

Table 1. Number of peanut seedlings per plot volunteering the year after establishment with two grasses. Species, Arachis monticola, plot size 4'x8'.

Companion Grass	Number of seedlings 5-17-71	6-1-71
None	14	38
Dallisgrass (thin stand)	19	49
Bahia	6	10

Publications:

1. Cope, W. A. 1971. Expression of heterosis in sericea lespedeza with competitive vs noncompetitive plant spacing. Crop Sci. 11: 761-763.

2. Cope, W. A., T. A. Bell, and W. W. G. Smart, Jr. 1971. Seasonal changes in an enzyme inhibitor and tannin content in sericea lespedeza. Crop Sci. 11:893-895.

3. Burns, J. C., R. D. Mochrie, and W. A. Cope. 1972. Responses of dairy heifers to crownvetch, sericea lespedeza, and alfalfa forages. Agron. J. 64:193-195.

***

NORTH DAKOTA

Legume plantings, higher elevations in the Black Hills, South Dakota

John McDermand (Bismarck)

We have been doing some work with a number of legumes near the limestone area of the Black Hills in South Dakota. This area is a few miles above Deerfield, South Dakota.

In 1968 we planted small plots of four legumes -- cicer milkvetch, Eski sainfoin, Emerald crownvetch, and Empire birdsfoot trefoil. They were planted in pure stands and also in mixtures of bromegrass and alta fescue. Good stands were obtained during the year of establishment.

In 1969 the Empire birdsfoot trefoil was excellent and made excellent growth. In 1970 it was still good, but made only about half the production it made in 1969. In 1971 the trefoil had about disappeared. I suspect this was due to winter-kill.

The Emerald crownvetch had a good stand established in 1968 and still had a fair stand in 1970. However, in 1971 the stand was very thin and spotted. Also probably due to winter-kill.

The Eski sainfoin had a good stand established in 1968. By 1970 there were only spots that were either fair or good. By 1971 there was little sainfoin remaining.

Cicer milkvetch had a good stand established in 1968 and still had a good stand in 1970. In the more open spots where there was very little grass, the stand was excellent. It was estimated that cicer milkvetch would cut two tons of hay per acre. In 1971 the civer milkvetch still looked excellent where it had been planted by itself but did not look very good were it was planted in the mixture with smooth bromegrass. This seems to indicate that cicer milkvetch would do much better in a pure stand than when it is planted in a mixture with grass.

A later planting made in 1969 on a larger scale included all four of these legumes in grass mixtures, plus a local yellow blossom alfalfa obtained from Claude Foster at Prairie City, South Dakota. To date the best looking legume in this planting is the yellow blossom alfalfa.

These legumes have a number of obstacles to overcome in these high mountain meadow plantings, some of which are late frosts in the spring and early grazing by numerous deer.

***

NOVA SCOTIA

Winterkilling Observations

J. S. Bubar (Truro)

Winter damage of forage legumes observed in the spring of 1972 was extreme throughout a large part of eastern Canada. The damage appears to have largely occurred during the spring (February to end of April) according to tetrazolium tests of material from fields that were observed by Dr. M. Suzuki (Research Station, Charlottetown, P.E.I.). We had unseasonable late snowstorms and icing during that period.

At N.S.A.C., alfalfa plots in pure stands were almost 100% killed. Only 100 surviving plants could be found in any area of 43 feet x 500 feet and these were restricted to a few of our hardiest varieties (Narragansett, Iroquois, Titan, W.L. 215, Thor, Anchor). Survival was better in grass mixtures but the most vigorous flemish varieties (e.g. Saranac) had little grass present when seeded in mixtures with timothy, orchardgrass or bromegrass and these mixture plots were dead in the spring. Other mixtures, like Vernal and Timothy had enough grass to provide a fair hay crop, although the alfalfa plants were mostly dead.

Other forage legumes suffered relatively less damage than alfalfa. Although all varieties of red clover and alsike seeded in pure stand in 1970 in plots adjacent to alfalfa were dead in the spring of 1972, all varieties of alsike seeded in observation rows in 1971 in another adjacent area survived well. Red clover double cut varieties seeded in 1971 had some differential survival while an entry of the single cut type survived well in most plots. Estimates of the percentage of plants to survive within varieties and strains in this trial are as follows: Single cut = 80%, Hungaripoli = 40%, Tetri = 18%, Maris Leda = 7%, Reicherberger = 17%, Lakeland = 30%, Ottawa = 25%, OM44 = 25%, Rotra = 10%, Violette = 42%, (Average of 4 replicates).

Although we have no white clover variety trial, volunteer wild white clover is present in many of the plots where the alfalfa was completely killed and it appears to have suffered little winter injury.

Birdsfoot trefoil of the varieties Leo and Empire also survived well in areas where all varieties of alfalfa were winterkilled. In a variety trial seeded in 1971, the percentage of surviving plants are estimated as follows: Leo = 95%, Wallace = 65%, Maitland = 7%, Westriver = 50%, Viking = 10%, Empire = 65%, N6-128 = 70%. (Wallace and Westriver are ecotypes found in Nova Scotia).

Astragalus cicer survived in an observation plot. It was slow to recover but deep rhizomes stayed alive. Zig-zag clover observation rows also survived well.

Forage grasses and winter wheat exhibited more winter damage than average but not as much as I would have expected from conditions that were so hard on alfalfa.

***

PENNSYLVANIA

Partial Characterization of Components in Crownvetch Deleterious to Meadow Voles

D. L. Gustine, G. W. Fissel, J. S. Shenk and R. F. Barnes
(University Park)

Feeding trials with voles fed crownvetch (Coronilla varia) resulted in adverse effects compared to alfalfa. Lowered feed consumption, weight loss and death occurred in many instances when fed crownvetch harvested at two growth stages for two years. Slight differences in response existed among cultivars and between growth stages and years. However, all crownvetch cultivars produced deleterious effects at both growth stages in both years. Normal growth responses were obtained when voles were fed crownvetch extracted with 95% ethanol.

The factor in crownvetch deleterious to meadow voles, was purified 50-fold. The procedure involved: (1) extraction with 95% ethanol; (2) conversion to an aqueous solution; (3) partitioning with a chloroform-ethanol mixture, to obtain the aqueous phase; and (4) partitioning that aqueous phase with ethyl fermate, to obtain the organic phase. These fractions were all active as determined by the meadow vole bioassay. The active component was not identified, but chemical characterization studies suggested that it was a flavonoid compound.

******

PENNSYLVANIA

Red Clover -- Root Borer

K. T. Leath, R. A. Byers, K. E. Zeiders (University Park)

1. The preference of adult clover root borers (*Hylastinum obscurus*) for diseased roots of red clover was reported last year. Subsequent tests have shown the borers' ability to select diseased root pieces buried in natural soil in preference to healthy root pieces (Table 1).

Table 1. Distribution of borers in clover root pieces buried in the soil.

Borers in center at start of test*	Location of borers after 24 hr: Healthy root	Diseased root	Soil
36	4	53	9

* Total from three tests.

Borers were also attracted more to leachates from field soil previously cropped to red clover than to leachates from field soil in which alfalfa had grown or leachates from greenhouse potting soil with an unknown crop history (Table 2).

Table 2. Number of borers selecting leachates from various soils

Treatment	Borers on wick
Distilled water	1
Alfalfa soil	10
Red clover soil	25
Greenhouse soil	11

2. A single, drench of benomyl fungicide (15.3g/m^2) in June, 1970 on plots of Pennscott red clover seeded in March of 1969 gave the following results:

   A) Yield in both 1970 and 1971 was increased over that of the untreated plots by 36%.

   B) The total number of plants/plot in September 1971 was: untreated 70; treated 241.

   C) Average dry weight per plant in September 1971 was: untreated 1.1g; treated 2.5g.

   D) There were twice as many clover root borers in the treated plants than in the untreated plants in September 1971.

   E) In September 1971 taproots were badly decayed but still present in many of the treated plants, many of which were judged to be originals. None of the plants from the untreated plots were judged to be originals.

Publications:

1. Leath, K. T., F. L. Lukezic, H. W. Crittenden, E. S. Elliott, P. M. Halisky, F. L. Howard, and S. A. Ostazeski. 1971. The fusarium root rot complex of selected forage legumes in the Northeast. Pennsylvania Agr. Exp. Sta. Bull. 777. 64 p.

2. Leath, K. T. and R. A. Byers. 1972. Preference for diseased roots by the clover root borer. Phytopathology 62:496.

3. Zeiders, K. E., J. H. Graham, V. G. Sprague, and S. R. Wilkinson. 1971. Internal breakdown of red clover (Trifolium pratense L.) in relation to environmental, cultural, and genetic factors. USDA Bull. ARS 34-126. 24 p.

******

SOUTH CAROLINA

Trifolium Investigations

O. W. Barnett, Chi-Chang Chen, and Pryce B. Gibson (Clemson)

Investigating the potential use of germplasm from Trifolium uniflorum and T. occidentale to improve T. repens is a big part of our program. We have eight F_1 hybrids from the cross T. repens x T. uniflorum. The variation in size and other characteristics among the eight hybrids is great. The eight hybrids were self-pollinated. Seed were obtained from two, and second generation plants from one. Backcrosses to the parent species and crosses among the hybrids were more successful. Some of these plants appear to be worthy of further investigation.

An F_1 hybrid from the cross T. uniflorum x T. occidentale (4x) and a backcross of this F_1 to T. uniflorum provide the opportunity to simultaneously transfer the germplasm of these species to T. repens. Crosses between these hybrids and T. repens result in a higher frequency of viable seed than from crosses between T. uniflorum and T. repens. Some of the resulting hybrids with T. repens are vigorous plants with good agronomic characteristics. We are optomistic about the use of these hybrids in breeding T. repens. Potentially this hybridization can result in a white clover with:

(1) shorter internodes
(2) larger seed (and possibly more seedling vigor)
(3) deeper and woodier roots
(4) more drought tolerance
(5) more disease resistance

Publications:

1. Chen, Chi-Chang and Pryce B. Gibson. 1971. Karyotypes of fifteen Trifolium Species in Section Amoria. Crop Sci. 11:441-445.

2. Chen, Chi-Chang and Pryce B. Gibson. 1971. Seed Development Following the Mating of Trifolium repens x T. uniflorum. Crop Sci. 11:667-672.

3. Gibson, Pryce B., Chi-Chang Chen, J. T. Gillingham, and O. W. Barnett. 1971. Interspecific Hybridization of Trifolium uniflorum L. Crop Sci. 11:895-899.

***

TENNESSEE

Publication: Changes in Stand Density and Carbohydrate Root Reserves of Two Varieties of Red Clover With Several Cutting Managements

Richard U. Clark and John H. Reynolds (Knoxville)

Clark, Richard U. and John H. Reynolds. 1972. Changes in stand density and carbohydrate root reserves of two varieties of red clover with several cutting managements. Tenn. Farm and Home Sci. Progress Report 82.

***

VIRGINIA

Grazing and *in vitro* tests for five varieties of crownvetch

John D. Miller (Blacksburg)

Two hundred spaced plants each of five varieties of crownvetch established in July 1971 were grazed from October 21-26, 1971. Growth prior to grazing had been relatively slow. Significant varietal differences were noted for initial height, final height, and inches removed by grazing (Table 1).

Samples from forty plants of each strain were analyzed by a modified Tilley and Terry procedure supplied by Dr. R. F. Barnes, U. S. Regional Pasture Research Laboratory, University Park, Pennsylvania. Varieties differed significantly with Penngift poorest (Table 1).

Table 1. *In vitro* and grazing data for five varieties of crownvetch, Blacksburg, Va., 1971.

Variety	Initial height (ins)	Final height (ins)	Inches removed	I.V.D.M.D.[2/] (%)
Chemung	7.96 a[1/]	2.10 a	5.86 b	76.27
Emerald	8.32 a	2.04 ab	6.28 a	76.80
Penngift	5.57 d	1.54 c	4.03 d	72.90
Md. Hay	7.50 b	1.88 b	5.62 b	76.54
Md. Pasture	7.09 c	1.94 ab	5.16 c	76.77

1/ Differences by Duncan's Multiple Range Test. Strains with any letter in common are similar.

2/ Varieties differed at probability level of .0123. LSD (5%) was 2.36%.

An attempt was made to relate *in vitro* values to grazing results. *In vitro* values were significantly correlated with initial height, inches removed, and percent of plant removed.

The test is being continued in 1972 with several grazings planned.

***

WASHINGTON

The Nitrogen, Tannin, Oxalate and Crude Fiber Content of a Collection of Lathyrus Species

A. M. Davis and D. M. Stout (Pullman)

Lathyrus species have been used extensively for ornamental and forage purposes. Lathyrus hirsutus is extensively used for forage in the S.E. United States, and Lathyrus sylvestris is the perennial Sweet Pea of Commerce. A number of other species have been introduced and could be valuable forages if there are no deleterious factors present. Lathyrism is a problem where L. hirsutus comprises a large portion of the forage diet of cattle. Lathyrus sativus is known to contain an additive compound that results in paralysis of the limbs of people. This condition is permanent and non-reversible when the total ingested has reached the toxic level. During times of famine seeds of L. sativus have been eaten in quantities large enough to bring about permanent paralysis. Some have speculated that the 'tares' of biblical notation could have been a reference to L. sativus.

In 1971 a collection of Lathyrus species was grown for seed increase and simultaneously for preliminary evaluation for forage quality. Seedlings were made April 7, 1971, and all had emerged by May 5; the plantings were irrigated as needed throughout the growing season. Fertilizer, 37-37-18, was side dressed June 5. Forage samples were collected when each accession was in full bloom.

The following table presents the results of these evaluations. (see next page).

These data illustrate the uniformity of the components tested, other than oxalates, particularly since annuals and perennials were included in the 14 species tested. The highest nitrogen content was found in Lathyrus sylvestris, P.I. 358893. If protein is estimated as N x 6.25, then a protein level of 33.68% was found in this accession. This is particularly high in light of the fact that this is in the range of dry split peas and higher than dry beans which are seldom over 28%. The dry forage of this accession is essentially equated as a protein concentrate. The lower nitrogen content is still equivalent to a protein of 18.31% on the same basis. The average for all accessions tested was 4.17% nitrogen, a protein equivalent of 26.06%. These data were collected only for the seedling year. How second year data on the perennial species would compare is not yet determined.

The crude fiber of this herbaceous forage was very low. The highest fiber was found in L. sylvestris, P.I. 358879, at 24.2%, and the lowest was found in L. pallescens, P.I. 358864, and L. aphaca, P.I. 358850, at 16.4%. These are very low in comparison to other dried legume forages. Good alfalfa hay has about 28% crude fiber.

Oxalates varied from a high of 2.45% to a low of 0.75%. The average for this component was only 1.24%. The variableness in this component is indicated by a C.V. of 34.8%. This level is very low and is of no concern

as a deleterious factor in the utilization of these plants for forage.

As a group, these plants appear to be good forage. They have high protein equivalent, low crude fiber, with tannin levels below those reported as acceptable in Serecia lespedeza and oxalate levels that are not in the potentially toxic range found in Halogeton.

Palatability and persistence under utilization pressures are unknown as are the levels of the factors causing 'Lathyrism.'

Further investigation as to the ultimate place of these plants in the forage regime of domestic animals and wildlife seems to be warranted.

Table 1. The nitrogen, tannin, oxalate and crude fiber content of some Lathyrus species.

Plant Inventory Number	Species	% Nitrogen	mg/g Tannins 1/	% Oxalates	% Crude Fiber	Origin
358855	L. annuus L.	4.00	8.2	0.95	20.4	Turkey
358850	L. aphaca L.	3.67	7.7	0.95	16.4	Pakistan
358856	L. aphaca L.	3.75	7.7	0.95	18.0	Turkey
358870	L. aphaca L.	3.78	7.7	0.80	17.5	Turkey
358873	L. aphaca L.	3.95	7.7	0.85	15.4	Yugoslavia
358857	L. cicera L.	4.42	8.2	1.40	22.2	Turkey
358858	L. digitatus Fiori & Paoletti	3.95	8.2	1.35	20.5	Turkey
358859	L. gorgoni Parl.	4.53	7.7	2.45	23.4	Turkey
358832	L. hierasolymitanus Boiss.	4.26	6.4	1.40	19.4	Israel
358860	L. hirsutus L.	4.24	8.6	1.00	22.6	Turkey
358861	L. hirsutus L.	3.80	7.2	0.80	22.0	Turkey
358886	L. hirsutus L.	4.73	9.5	0.85	16.7	Alabama
358889	L. latifolius L.	3.78	6.9	1.55	19.5	Arkansas
358876	L. nissolia L.	3.50	7.2	0.75	22.6	Yugoslavia
358864	L. pallescens C. Koch	2.93	5.9	1.45	16.4	Turkey
358848	L. pseudo-cicera Pampam.	4.32	6.4	1.00	18.4	Israel
231456	L. sativus L.	4.44	6.9	1.40	22.8	Iran
342632	L. sativus L.	3.91	6.4	1.36	24.0	Israel
358877	L. sativus L.	4.26	10.5	0.75	18.0	Yugoslavia
358891	L. sativus L.	4.95	8.2	1.90	22.2	Minnesota
358879	L. sylvestris L.	4.55	6.9	2.00	24.2	Yugoslavia
358880	L. sylvestris L.	5.00	8.2	1.85	19.8	Yugoslavia
358893	L. sylvestris L.	5.39	7.7	1.20	20.9	Maryland
358872	L. sp.	3.80	7.2	0.80	21.3	Turkey
358895	L. tuberosus L. */	4.60	8.2	1.25	18.1	Nebraska
358896	L. tuberosus L. */	3.89	8.2	1.15	17.0	Nebraska
	Mean	4.17	7.8	1.24	20.0	
	C. V.	12.4%	12.7%	34.8%	12.9%	

1/ gallo-tannic acid equivalent

*/ perennial species

WISCONSIN

Red Clover Breeding & Genetics

R. R. Smith and D. P. Maxwell (Madison)

Northern Anthracnose Resistance in Red Clover. Resistant and susceptible red clover clones were intercrossed to study the inheritance of resistance to Kabatiella caulivora (Kirchn.) Karak., causal agent for northern anthracnose. Evaluation of F_1, F_2, and BC progeny reactions to this fungus indicated that resistance was dominant and controlled by more than three genes. Fity-one percent of the plants were resistant to K. caulivora after two cycles of recurrent phenotypic selection, whereas, 5 percent of the initial population were resistant.

When susceptible clone, Pen 3, was crossed to various highly resistant clones, the F_1 progeny had varying percentages of resistant plants. Furthermore, the polycross progenies resulting from intercrossing resistant plants 8-2, 8-1, 8-3, 8-6, 23-4, and 18-2 when inoculated with a mixture of four K. caulivora isolates had 86, 70, 65, 63, 59, and 36 percent resistant types, respectively. It would appear that resistant plants can be of varying degrees of heterozygocity for the resistant factors. Therefore, breeding for resistance to northern anthracnose in red clover might best be accomplished by first progeny testing resistant plants using a highly susceptible clone such as Pen 3 as the tester clone. The percentage resistant F_1 plants from each cross would provide a basis for selection of the most resistant plants to enter into a recurrent selection program.

Results of root borer (Hylastinus obscurus) preference trial on red clover.

Materials screened:

Nineteen red clover plants (71-1 to 71-9) showing little or no borer feeding were selected in September, 1971, from 3- and 4- year old red clover stands on the Arlington Farm. These stands were heavily infested with root borers in June and again in September of 1971. The roots and crown of each plant were washed and stored in a refrigerator until subjected to the preference test outlined below.

Root borer preference test:

This test consisted of two trials with each plant being represented in each trial twice (except 19), thus, providing four values for each plant. Test material consisted of a 3 to 6 mm in diameter by 5 mm in depth cross section of the root. Since plants were of considerable age, secondary roots were used on occasions. Each trial consisted of 4 petri dishes with filter paper and contained different plant specimens. Adult borers were introduced to each dish at 10 a.m. The dishes were then placed in the dark and the number of borers feeding on each specimen was recorded at 1:00 p.m. All borers were removed and accounted for and placed back in the dish at this time. A second recording was made at 4:00 p.m. and again borers removed and reintroduced. A final recording was taken at 8:00 a.m. the following day. The difference between the two trials was the selection of plants placed in each dish and the number of borers used.

Sixteen adult borers were introduced to each dish in trial 1 and 20 into each dish in trial 2.

Results:

The results of these two preference trials are given in Table 1. It would appear that there was some degree of selective feeding. Plants were classified as resistant or susceptible to borer feeding based on the total number of bores observed feeding on each. A plant with 8 or less borers feeding was considered resistant. Resistant plants 71-1, -3, -5, -6, -8, -9, and -17 and susceptible plants 71-7, -10, -11, -13, and -19 were selected for crossing to study inheritance of this condition.

Testing red clover for resistance to Stemphylium sarcinaeforme.

Initially, various parameters of inoculation were studied. Maximum disease development was obtained with a concentration of 1.3×10^6 spores/ml of 0.12% Tween 80. After inoculation, plants were incubated for 24 hr in dew chambers at 16, 20, 24 or 28 C and then removed to growth chambers at the respective temperatures for 6 days. The greatest number of lesions occurred on the plants incubated at 28 C while the smallest number of lesions were on the plants at 16 C. The highest disease severity was at 20 and 24 C. The lesions at 28 C were about 1/5 the size of those at 16 C. Several clones originally selected by Dr. S. Braverman, Geneva, New York, from P.I. 235845, 235851 and 235858 for their resistance to S. sarcinaeforme were screened under standard conditions (3.4×10^5 spores/ml of 0.12% Tween 80, at 22 C for 48 hr in humidity chamber). Lesions developed on all clones but in some cases the plants were considered to be moderately resistant. All these clones were susceptible to Erysiphe polygoni.

Resistance to Rust in Red Clover (M. C. Engelke - cooperating).

A single spore population of the rust fungus Uromyces trifolii var. fallens was developed from a bulk spore population collected from infected red clover leaves at Arlington Experiment Station, Arlington, Wisconsin in the fall of 1968. The single spore population is maintained and increased in growth chambers held at 16 C with 12 hr day length and is used for screening and testing numerous sources of rust resistant germ plasm.

Clone KyCL 75 (L75) was selected from the red clover variety Lakeland in Kentucky in 1965 and was obtained from Dr. S. Diachun, University of Kentucky in 1971. He reported evidence suggesting that resistance may be controlled by a single dominant factor and that L75 is heterozygous for this factor. L75, further characterized by having no leaf markings, was crossed to a rust susceptible clone, L12, also of Lakeland origin but with a leaf mark. Approximately 200 F_1's were inoculated and scored for rust reaction. This population segregated 1:1 for this disease. Segregation for leaf markings approximated a 9:7, no mark to mark ratio.

Eight resistant F_1 plants were selected and intermated at random using honey bees, thus generating a F_2 population. Eight susceptible F_1 plants were treated likewise. These populations will be used to test the hypothesis that resistance is dominant and controlled by a single gene.

Resistance to rust was also found in P.I. 304784 obtained from Geneva, New York. The seed originated from the Swedish cultivar 'Ulva'. The P.I. was screened in the greenhouse, tested and yielded two immune plants, designated MPI 6-2 and MPI 6-5. Both of these clones are characterized by being cross-incompatible with most of our germplasm. MPI 6-2 is relatively self-incompatible setting a low percent of self-seed, whereas, MPI 6-5 is highly self-compatible. Self seed of MPI 6-5 was obtained by tripping flowers with a toothpick. Heat treating buds of MPI 6-2 followed by subsequent selfing yielded I_1 seed.

Crossing data and cytological evidence suggest that these two plants are other than diploid, presumably tetraploid or slight deviations therefrom. Forty eight I_1 progenies from MPI 6-5 segregated in a ratio of 28 resistant to 20 susceptible. Comparatively, 45 I_1 progenies from MPI 6-2 segregated in a resistant to susceptible ratio of 39:6. Selected I_1 plants from each parent have been selfed and the I_2 progenies will be evaluated for their reaction to rust.

A third source of resistance was obtained from P.I. 210370, an introduction from Iran. Two plants designated MPI 5-3 and MPI 5-4 are highly resistant but not immune to the rust pathogen. F_1 and BC data suggest that this resistance to rust is under polygenic control. MPI 5-4 is a poor pollen parent, possibly partially male-sterile, while both plants behave as normal diploids according to crossing data.

Publication:

Maxwell, D. P. and R. R. Smith. 1971. Development of red clover germ plasm resistant to Kabatiella caulivora. Plant Disease Reptr. 55:920-922.

******

Table 1. Performance of red clover plants as a result of root borer preference test. Madison, Wisconsin. September 1971.

Plant	Total No. of root borers feeding*				Total borers feeding	Rank	Classification
	Trial 1		Trial 2				
	Set 1	Set 2	Set 1	Set 2			
71 - 1	0	1	6	1	8	5	Res.
- 2	1	2	0	17	20	11	Suc.
- 3	0	1	0	0	1	2	Res.
- 4	0	7	4	0	11	7	Susc.
- 5	0	2	0	2	4	3	Res.
- 6	0	1	6	0	7	4	Res.
- 7	3	30	23	9	62	17	Susc.
- 8	0	0	0	0	0	1	Res.
- 9	0	0	0	0	0	1	Res.
-10	6	13	2	1	22	12	Susc.
-11	15	8	6	3	32	13	Susc.
-12	0	3	8	3	14	8	Susc.
-13	8	19	8	18	53	16	Susc.
-14	8	2	5	1	16	10	Susc.
-15	0	1	13	1	15	9	Susc.
-16	3	6	0	1	10	6	Susc.
-17	2	2	0	0	4	3	Res.
-18	0	10	16	15	41	15	Susc.
-19	-	23	2	9	34	14	Susc.

* Value per trial per set is total of three recordings. Not all borers included because some were not feeding at time of count.

WISCONSIN

Viruses in Red Clover

M. A. Khan and D. P. Maxwell (Madison)

Viruses caused substantial losses in red clover each year in Wisconsin. The most prevalent viruses are bean yellow mosaic virus (BYMV), Wisconsin pea streak virus (WPSV), alfalfa mosaic virus (AMV), and red clover vein mosaic virus (RCVMV). Since no red clover varieties resistant to these viruses are available, a breeding program was initiated. Red clover clones resistant or susceptible to RCVMV were selected from mass screening tests. Preliminary results indicate that resistance to RCVMV is governed by a single dominant factor.

RCVMV has been partially purified and production of antiserum against this virus is underway. Presently, investigations are concerned with development of serological techniques which can be used in a mass screening program, characterization of RCVMV-induced crystalline inclusions, and inheritance of resistance.

***

WISCONSIN

Summaries of white clover, birdsfoot trefoil, and crownvetch variety trials at Arlington, Wisconsin

Howard W. Ream (Madison)

Table 1. Ladino Clover Variety Trial, Arlington, Wisconsin.

Variety or Synthetic	Dry matter - tons/acre 1970	1971	Avg.
Gigante (Cert. Italy 1967)	3.84 a	1.96 ab	2.90
Merit (Cert. Calif. 1968)	3.36 b	2.25 a	2.80
Regal (Cert. Calif. 1968)	3.83 a	1.67 bcd	2.75
Espanso (Cert. Italy 1967)	3.82 a	1.68 bcd	2.75
Ladino (Cert. Calif.)	3.25 b	1.78 bc	2.52
Minn A	2.26 c	1.25 d	1.76
Common	2.17 c	-- *	
La. S-1	2.17 c	-- *	
Nolins (La. 1968)	2.16 c	-- *	
CV (%)	7.6	16.4	

* Winterkilled in 1970-71.

Soil: Plano silt loam
Seeded: May 1, 1969, with Planet Jr. in 8" drill rows
Design: Randomized block, 4 replications
Plot size: 6'x17', 4 of 8 rows harvested
Cutting Schedule (2" ht.): 1970 - 6/1, 6/18, 7/14, 8/21, 10/23;
1971 - 6/9, 6/29, 7/26
Fertilizer: P and K annually according to soil test recommendations.

Supervisor: H. W. Ream

Table 2. Birdsfoot Trefoil Variety Trial, Arlington, Wisconsin.

Variety or Synthetic	Dry matter - tons/acre 1970		1971*	Avg.
Leo	2.60	a	2.45	2.52
Viking	2.63	a	2.38	2.50
Maryland No. 1	2.44	ab	2.44	2.44
S-7309 (Sask. Comp.)	2.30	bc	2.26	2.28
Dawn	2.05	c	2.51	2.28
Empire	1.98	c	2.26	2.12
CV (%)	8.1		5.7	

* Not significantly different.

Soil: Plano silt loam
Seeded: May 1, 1969, with Planet Jr., in 8" drill rows
Design: Randomized block, 4 replications
Plot Size: 6'x17', 4 of 8 rows harvested
Cutting Schedule (3 in. ht.): 1970 - 6/12, 7/16, 9/8;
1971 - 6/8, 7/20
Fertilizer: P and K annually according to soil test recommendations.
Supervisor: H. W. Ream

Table 3. Crown Vetch Variety Trial, Arlington, Wisconsin, 1971.

Variety	DM-t/acre*
Emerald	3.47
Chemung	3.16
Penngift	2.79
CV (%)	12.1

* Not significantly different.

(Footnotes on next page)

Table 3 (Footnotes):

Soil: Plano silt loam
Seeded: May 1, 1969, with Planet Jr. in 8" drill rows
Design: Randomized block, 4 replications
Plot Size: 6'x17'
Cutting Schedule: 1970-not harvested, thin stands.
1971: 6/8, 7/20
Fertilizer: P and K according to soil test recommendations

Supervisor: H. W. Ream

In addition to this data, I have some observations on winter killing in white clover and birdsfoot trefoil as a result of the very severe 1971-72 winter in southern Wisconsin. All of the Ladino clover varieties shown in Table 1 were winter killed, as were all varieties in a seeding made in the spring of 1971. Included in the latter test were: Minn. Sel. A, Ladino, Merit, Gigante Ladino, Espanso, and Regal. Kura clover, Trifolium ambiguum, seeded along with white clover in the former trial (Table 1) in the spring of 1969 has survived.

Of the birdsfoot trefoil varieties in the trial shown in Table 2, Viking and Maryland No. 1 were completely winter killed, while Empire, Leo, and S-7309 (Sask. Comp) suffered very little if any damage, with Dawn damaged slightly. In new seedings made in the spring of 1971 at Arlington and Lancaster, Wisconsin, Leo, Carroll, Empire, and S-7309 (Sask Comp) were not damaged and are good stands; Ky Ecotype, Bowman, and Dawn are in fair shape; and Mansfield, Negative HCN, Maitland, and Maryland #2 were completely winter killed. New 1971 birdsfoot trefoil seedings at Spooner, Wisconsin all survived as did all varieties in old stands at Ashland, Wisconsin. In these locations there was adequate snow cover all winter.

***

SPECIES INDEX

******